

Building the Machine in the Woods: Reconciling Technology and Architecture

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May, 1983

Submitted to the Department of Architecture in partial fulfillment
of the requirements of the degree Master of Architecture at the
Massachusetts Institute of Technology.

June 1991

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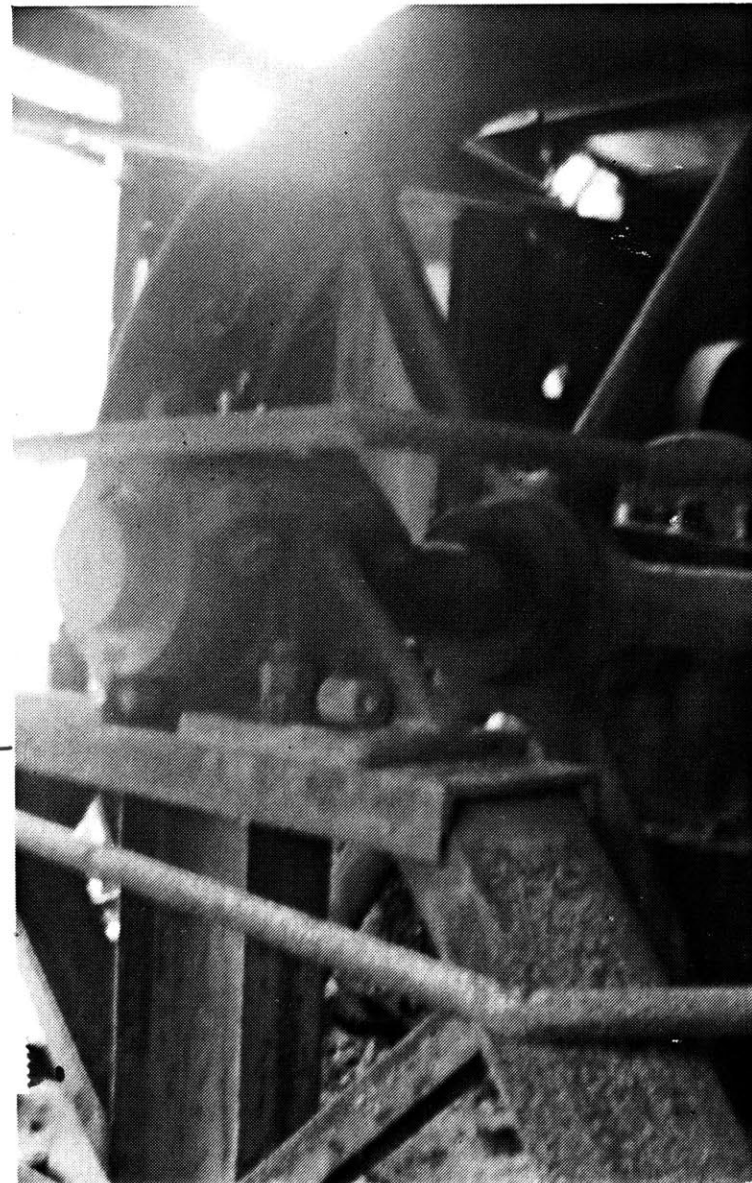
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Abstract

Building the Machine in the Woods: Reconciling Technology and Architecture

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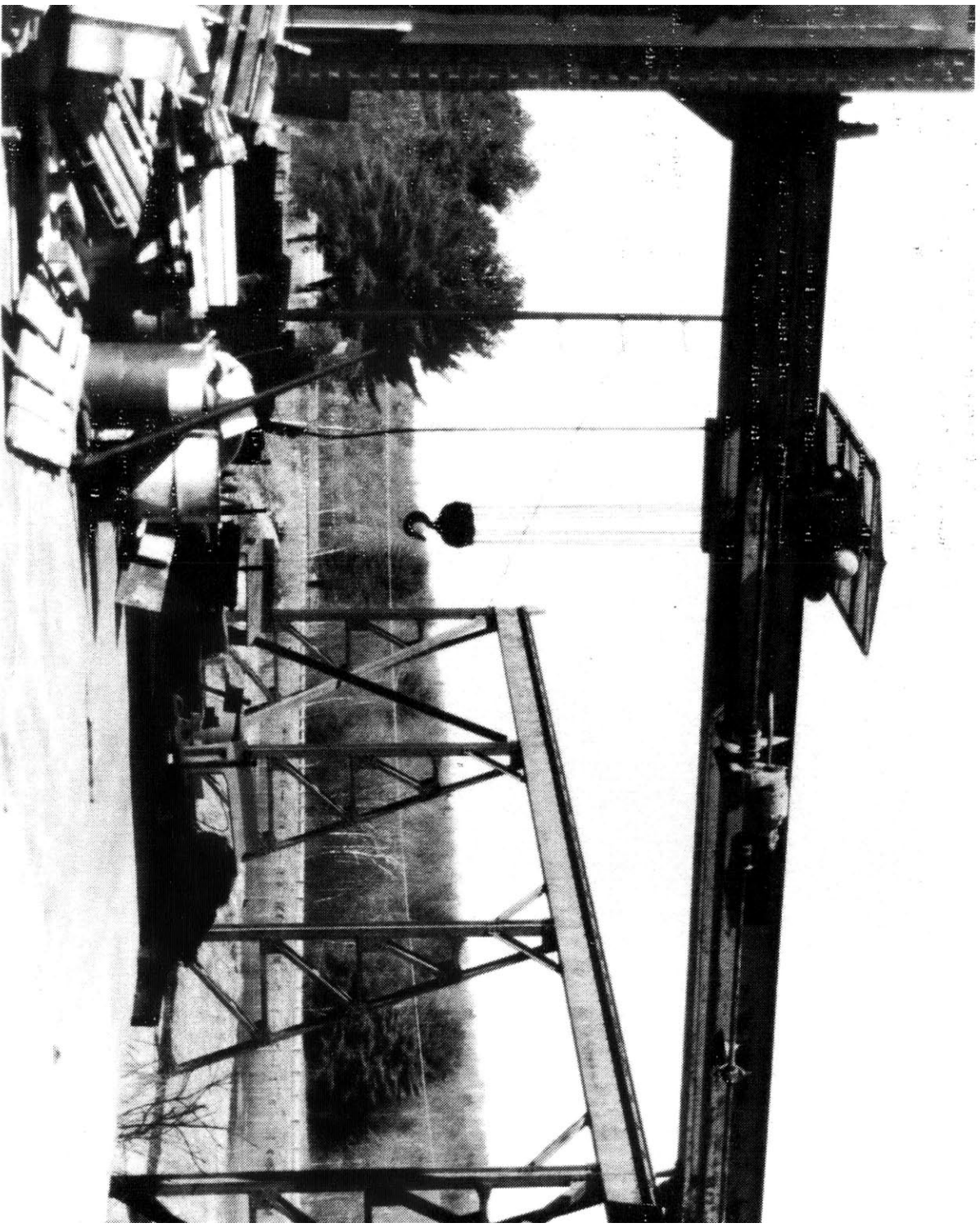


Given the fact that, to some degree, all buildings are technological phenomena; first, how do we select the appropriate technologies for a given set of requirements; and, more importantly, how do we find architectural and landscape forms which express the pragmatic reality of the technologies as well as their temporal and symbolic implications? In so doing, are there ways in which the dynamism of the activities within the place can inform the making of the place and are reciprocal levels of information between the two possible? Can the processes of the architecture and construction of a building reflect processes within it?

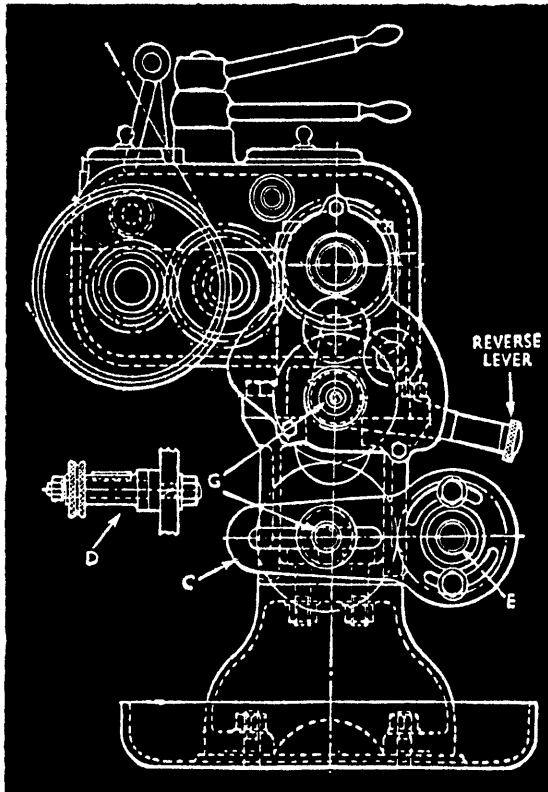
The position is put forward that siting and form-making decisions which integrate the technologies inherent in building construction and building operation are possible and desirable.

The implications of this position promote the utilization of all parts of a building in the creation of space, light and texture. They suggest that buildings can be created that reveal the way they are built and operate without denying the technology which created them or revealing in it. They encourage that the lines between the artifact, the technology which created it and the technology which operates within it be removed to render a more comprehensive understanding of its use and making. The intention of this undertaking is to understand what roles the technologies inherent in the construction processes and building operations can play in informing and empowering the architectural and landscape decisions. Additionally, an effort will be made to understand the legacy of technology in the landscape and how this phenomena affects the resultant architecture.

The vehicle for this investigation will be the design of a teaching center for ceramic, glass and sculptural arts to be located at the edge of a school campus in western Massachusetts. The center is currently being planned to allow for the expansion of other visual arts disciplines in existing facilities. The school is located along both banks of the Connecticut river where Vermont, Massachusetts and New Hampshire join together. The specific site is along a powerful stream and falls within a deep ravine at the base of the Pisgah Mountains.



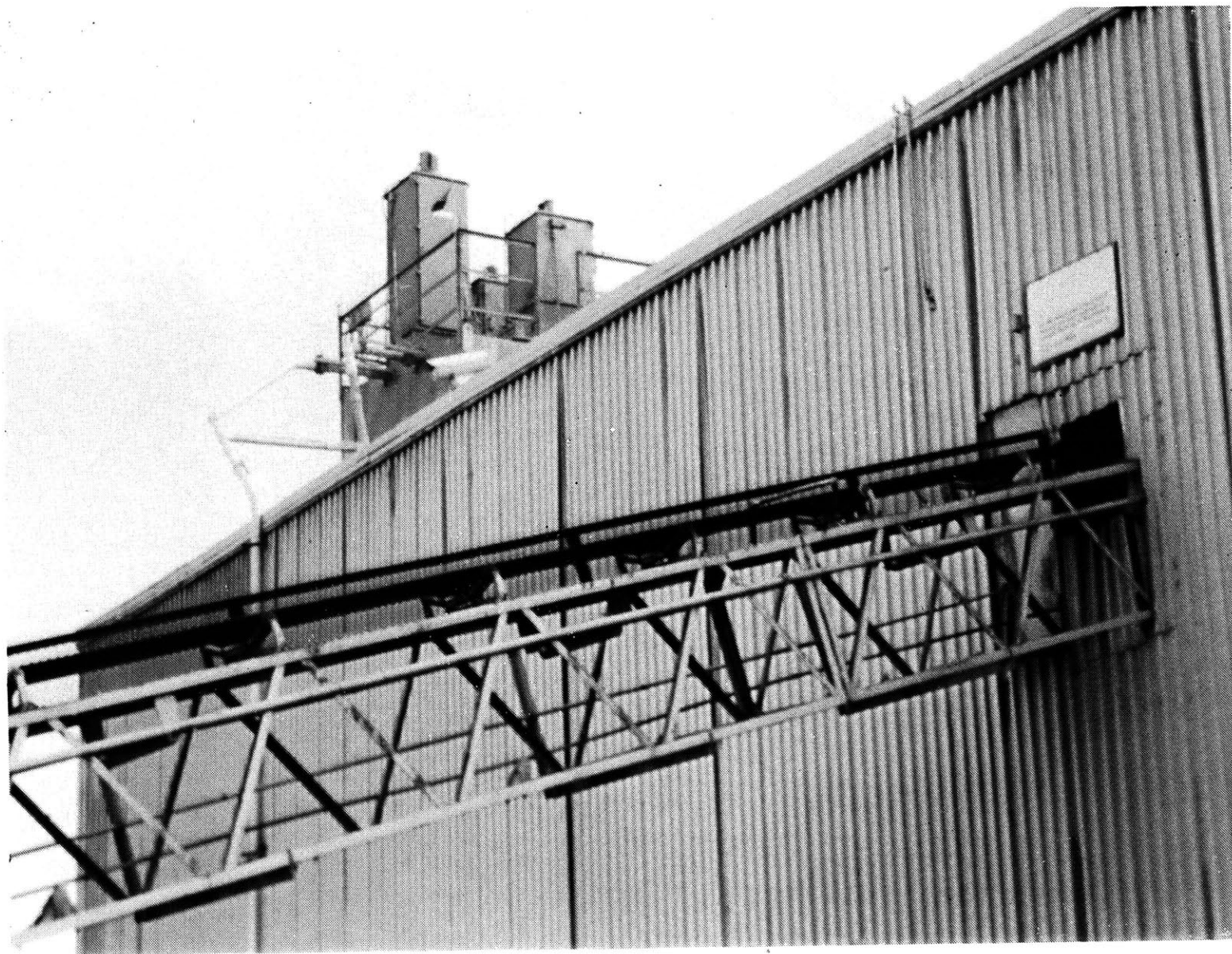
Part One: Premise

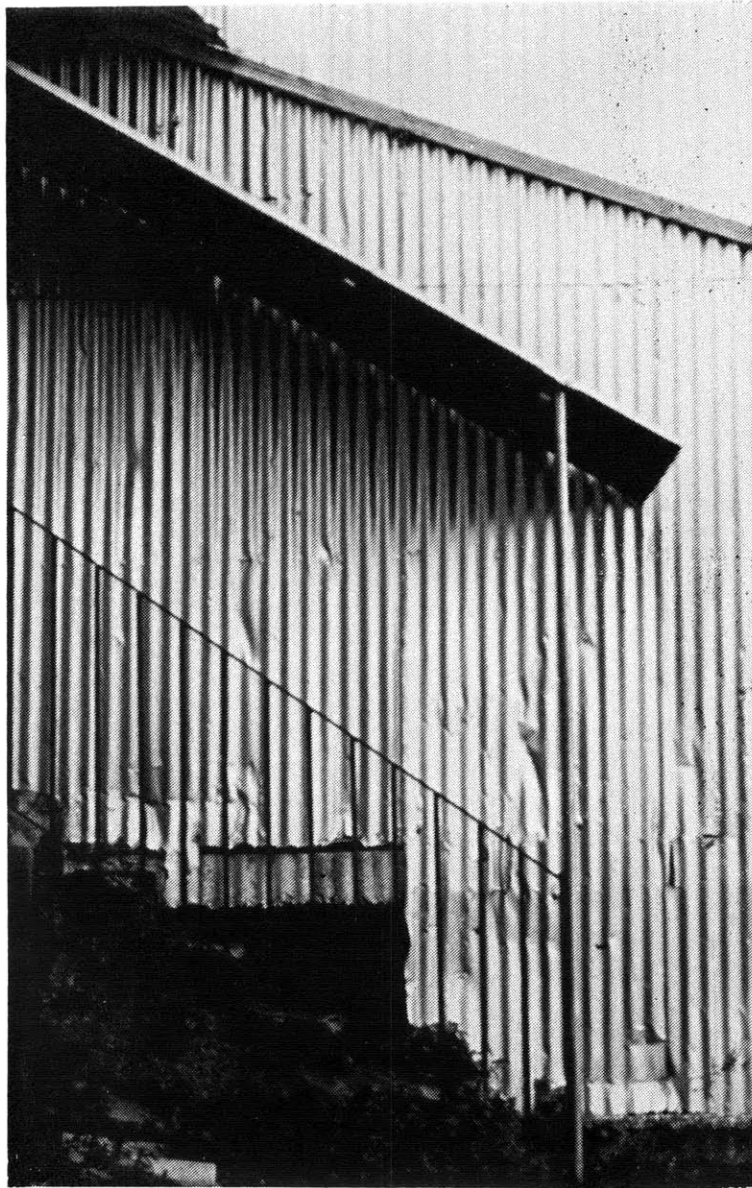


*Technology is therefore no mere means. Technology is a way of revealing... *Techne* belongs to bringing forth, to poiesis; It is something poetic...Essential reflection upon technology and decisive confrontation with it must happen in a realm that is, on the one hand, akin to the essence of technology and, on the other, fundamentally different from it.*

*The Greeks conceive of *techne*, producing, in terms of letting appear. *Techne* thus conceived has been concealed in the tectonics of architecture since ancient times.*

Martin Heidegger



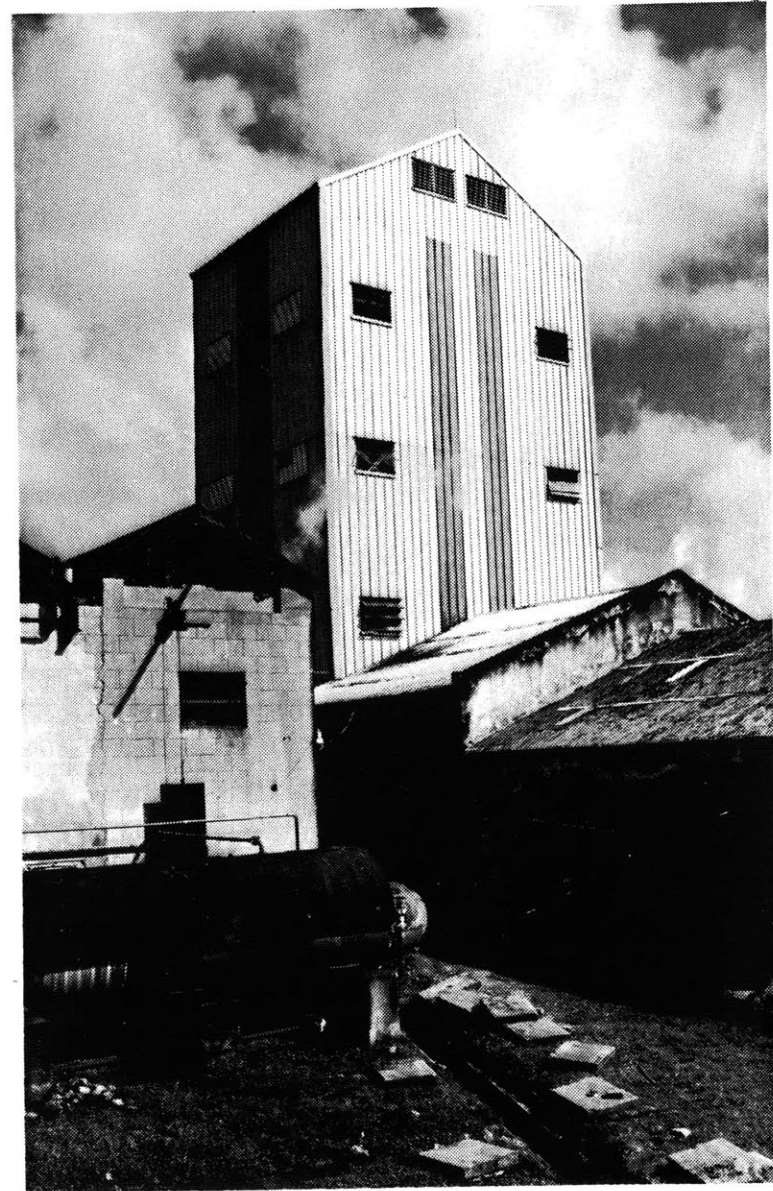


Unlike the majority of creative disciplines, architecture is saddled with the responsibility of responding to external forces which go beyond its realm as an artistic medium. Whether these forces are as simple as providing shelter or accommodating specific tasks, the resultant artifacts are imbued with the inert technologies of their making as well as those which remain active in the form of their continued operation. When these technologies are suppressed the concluding form loses the strength of its expressive potential, when the technologies become the driving force in the architecture, the reading of the form becomes equally subverted. Between these phenomena lies the possibility to integrate architecture, landscape, construction technologies and operating technologies, solutions which deal with "the facts of the case".

The various structures illustrated throughout this section share a common heritage. Although they were made by different hands and erected for different purposes, they all have a "materiality" and

"clarity of form" which is too often absent in contemporary architecture. In all instances, these structures express both the technology of the building (internal) and the technology for the building (external). In doing so, they take on metaphysical meaning, an architecture with a little "a".

This "materiality" requires definition. In many senses, it is rooted firmly in tectonics. Yet its meaning implies something beyond simple tectonics. It suggests a sensitivity to the construction methods which acknowledge the inherent qualities of the elements which are employed. It is sympathetic to material scales; mindful that certain components yield different perceptions in the context of the hand, the body, and the landscape. It possesses a strong predilection for the "part" over the "product", demanding buildings which are assembled rather than manufactured. Lastly, it is sensitive to the temporal qualities of materials, preferring the patina through use, time, alteration and decay to the perception of perfection and homogeneity.



The choice of fabrication methods which respect material qualities is a complex one. In a world where shrinking levels of natural resources are being challenged by increasing demand for them in the construction industry, the technology of providing materials has more than kept pace. The same building industry that has brought about new materials such as low-e glass and insulated aluminum cladding panels has also introduced stone veneer, glue-on brick, and snap-out divided lite windows. The opportunities for the introduction of new, authentic materials is often offset by the willingness of the manufacturing community to exploit available technologies in order to save costs and expedite the assembly process. This most often occurs through efforts to replicate construction techniques and assemblies which were, in their original state, a result of an understanding of the capabilities and characteristics of their component materials. The focus of this selection is not to enforce an authenticity through some form of false primitivism, but rather to extend the understanding of applications and methods of both new and traditional materials so the resulting use of these materials does not present a conflict with reality of a building, either tectonically or temporally.



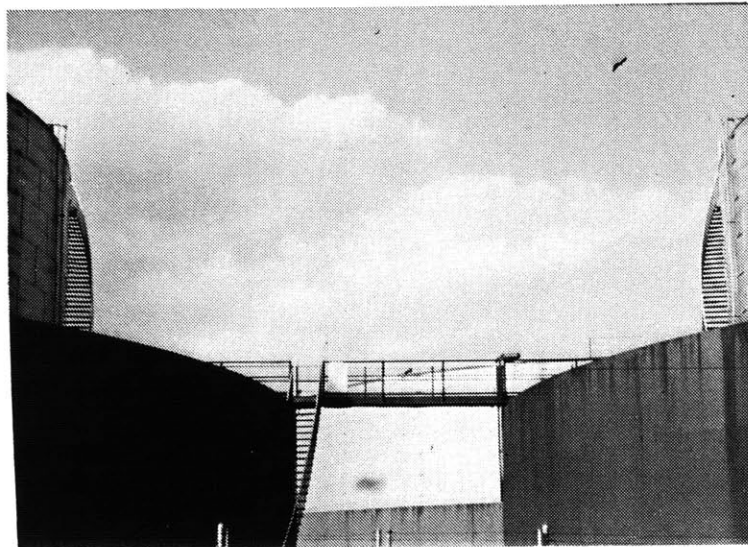
The breakdown of architecture through its various scales is accomplished both spatially and materially. The reading of a building develops at three scales, the environmental, the anthropometric and the tactile; building materials must do the same. It is here that the material scales are most crucial. The gaging of relationships between the human body and the built environment is successful when the space, structure and materials enforce one another. The consistent use of material scale allows the understanding of the size of the body to the size of the building even when spatial and structural means are not available. These scales can be reinforced through the most subtle of means, from the memory of the dimension of the plywood formwork for a monolithic concrete pour to the bolted connection which might secure a massive steel column to its grout pad. In all cases there is the reminder of the presence of the human body which assembled it as well as the technology which created it.

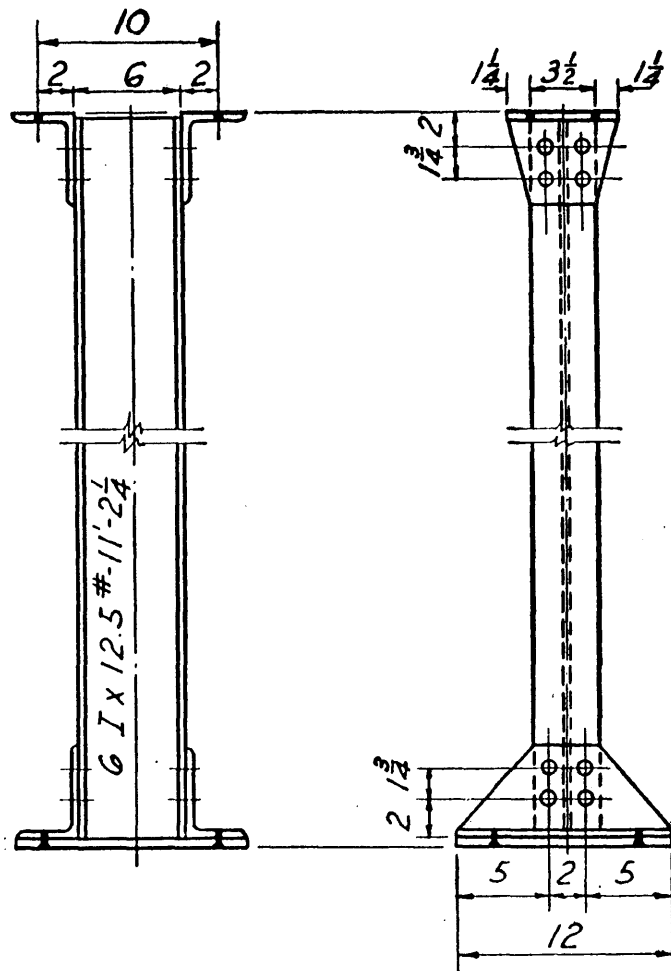
A building's technological stance can be further understood by the

degree to which it is read through its readily identifiable parts and assemblies rather than anonymous value added products and manufactured components. The heroic vision of manufactured buildings has brought with it the implicit divorce of craft and artifact. As the act of building becomes further removed from the building itself, the opportunity to understand the project as an extension of human will is in jeopardy. We can look at any brick in a brick wall and imagine the mason (and through him ourselves) sighting the brick, leveling it and, finally tamping into place in near perfect alignment. The opportunity for understanding the process and technologies of making is lost when we are confronted by prefabricated toilet modules, 90 foot post-tensioned concrete tees or wafer-thin stone veneer panels. In all of these cases, the sophistication of the manufacturing methods belies any human participation. The possibility of projecting one's self into the building's construction is gone and so is an opportunity to fully comprehend it.

The temporal framework by which buildings are understood is implicit in the choice of materials. Materials which undergo transformations as a result of exposure to the elements serve to intensify a building's sense of place as well as provide an historical framework by which it is read. The technological solutions which attempt to deny the patinization process may very well extend the life of a building but in so doing they deny the possibility for the narrative of the building through its materials. Furthermore, these solutions often rely on extreme feats of materials manipulation. Many of which require greater maintenance than had a material been chosen which could modify itself as a result of the exposure to the elements rather than attempt to withstand them. The efforts to forestall, or deny, the effects of use and nature may indeed be a means by which to deny the reality of a building, as if to keep it in the realm of the drawing board where it is always pristine and unused.

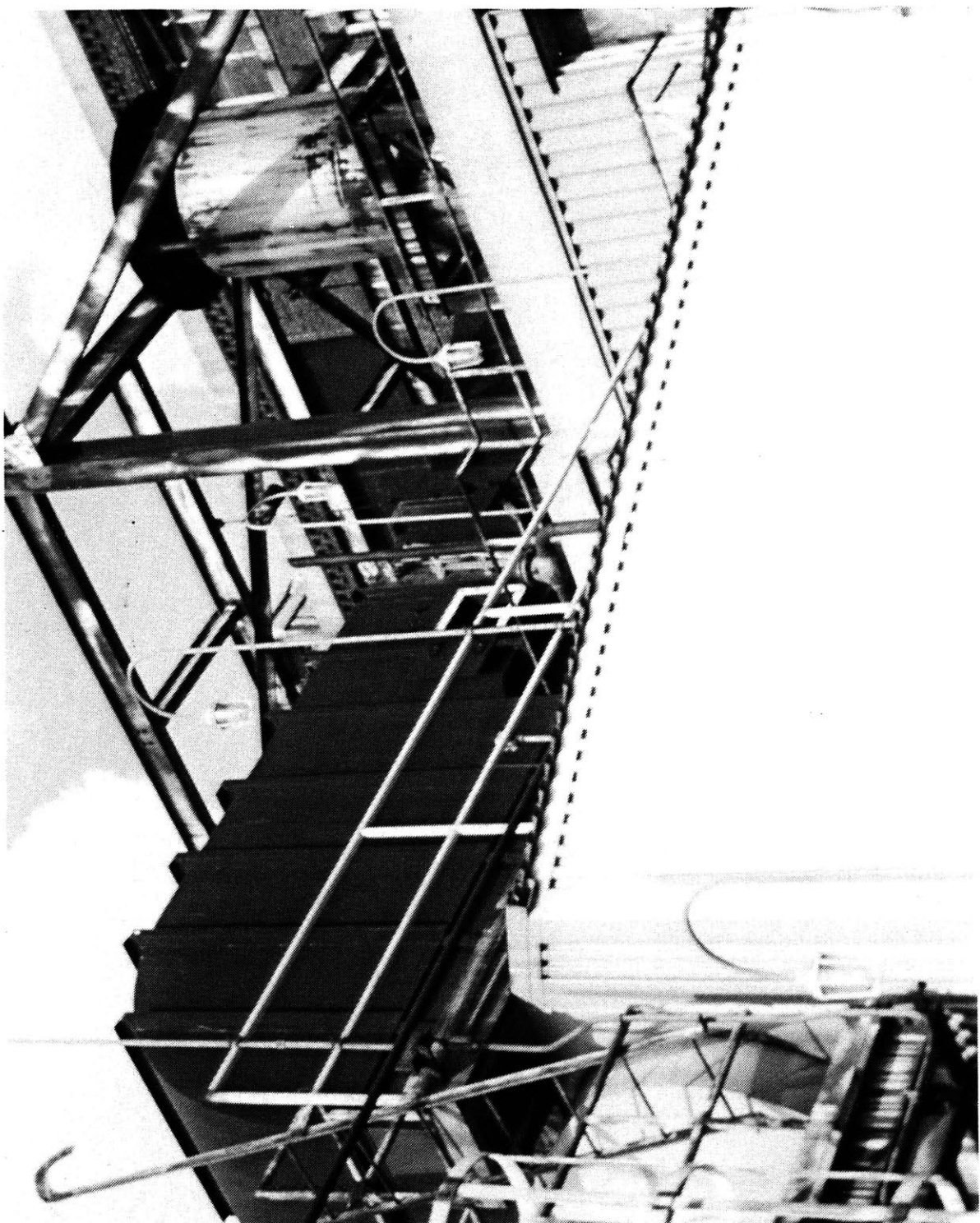
The notion of "clarity of form" also invites definition in the context of this investigation. It is allied with a sensibility which encourages the selection of structure which is readily comprehensible rather than reliant on scientific knowledge. It prefers an ordering of space and

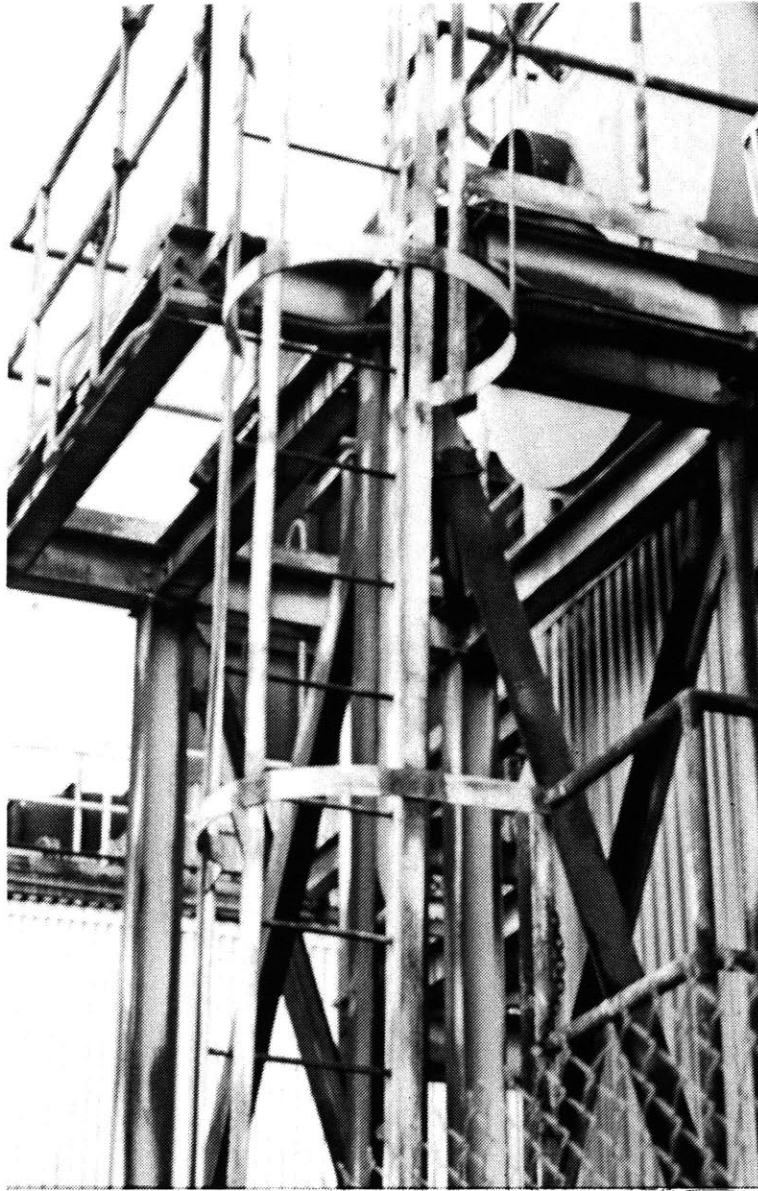




structure which, by being devoid of formalist conventions, can be readily transformed to adapt a variety of changes in use or, eventually, disuse. It is a legacy which prefers to see the working parts rather than embed them within cowlings or shrouds and, thus demands a means of creating architecture where building systems participate in the making and definition of space and territory. Lastly, it suggests a method of form-making which is empowered by evocative means rather than external appropriations.

The need for comprehensible structure is tied directly to the efforts to understand architecture at its largest scale. By being able to readily identify how the various building components are participating in the load path and, as a result being able to read the overall structural strategy for a building, one is immediately aware of the technological position of the building. While the technical details of moment connections, shear planes and bolt sizes may be lost on the layman, there is clear understanding of what is supporting what. As important



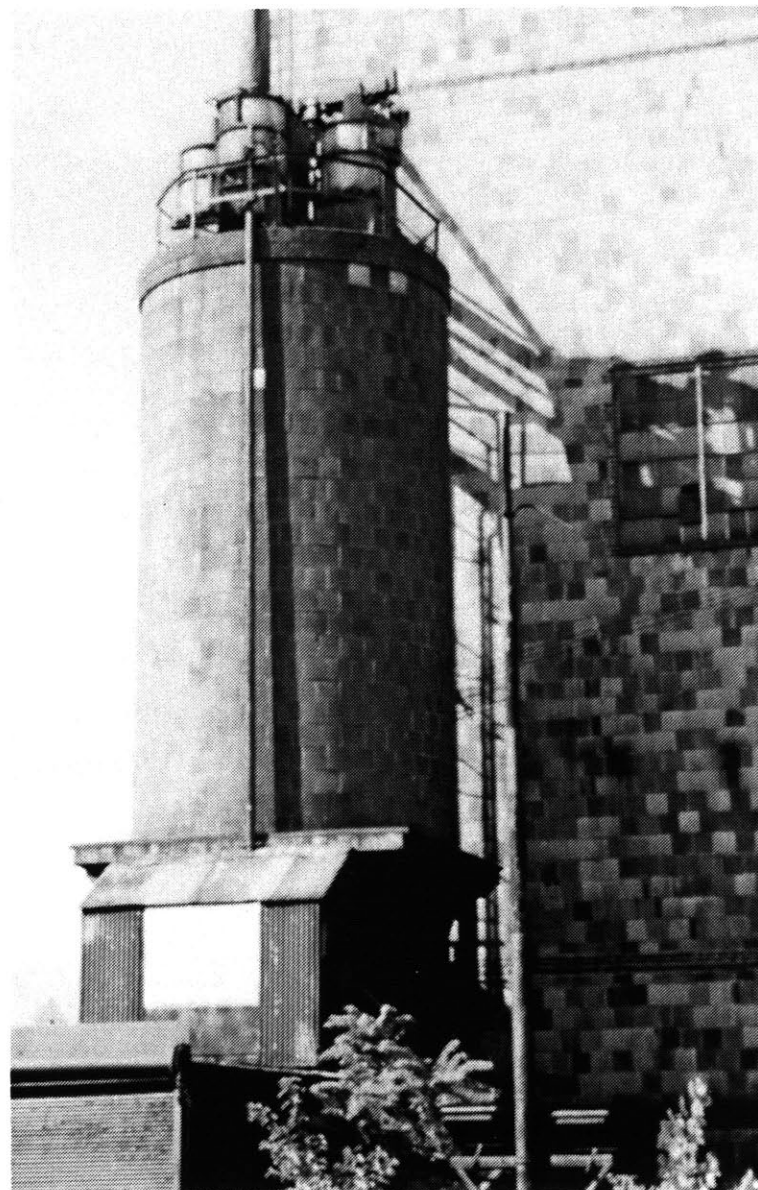


as the correct sizing of structural members for gravity and lateral loads is the need to have the perceived structure be sufficient. Engineering gymnastics such as post-tensioned concrete beams, heavily reinforced concrete cantilevers or cable-stayed structures which solve the straightforward structural solution through advanced mathematical and scientific knowledge seem to lose this identifiability as the root issues are no longer readily understood. In so doing, the efforts have passed from the builderly tradition to the engineering tradition.

Conveying the means by which a building operates is essential to its overall legibility. While much of architecture, as a result of the move away from manufacturing toward the anonymity of a service economy, no longer contains the typological clarity of its predecessors, the opportunity still exists to convey the mechanics of the building. By understanding the systems present in a building, and interweaving them as part of the architecture rather than treating them as additive components, the opportunity to blur, or hopefully erase, the lines

between a building and its engineering exists. This, in turn, allows the possibility of reading the architecture as an assemblage of places whose defining forms are generated by the mechanics of the tasks at hand.

The desire for the ordering of space and structure to solve the requirements for a given problem rather than conform to rigid, formal planning efforts is an extension of the builderly, if not vernacular, tradition. When a structural and spatial ordering system is formulated to suit the job at hand, then its reading is limited to the role in the building which it is performing instead of external aesthetic conventions. In so doing, this allows a more open-ended condition which invites addition to, modification of and, ultimately, removal of any or all of its components. This is not suggestive of the notion of ultimate spatial flexibility of Miesian free space or the anonymity of the omniplatz, but rather that a space is developed to house a specific function and, over time, may or may not be conducive to other func-

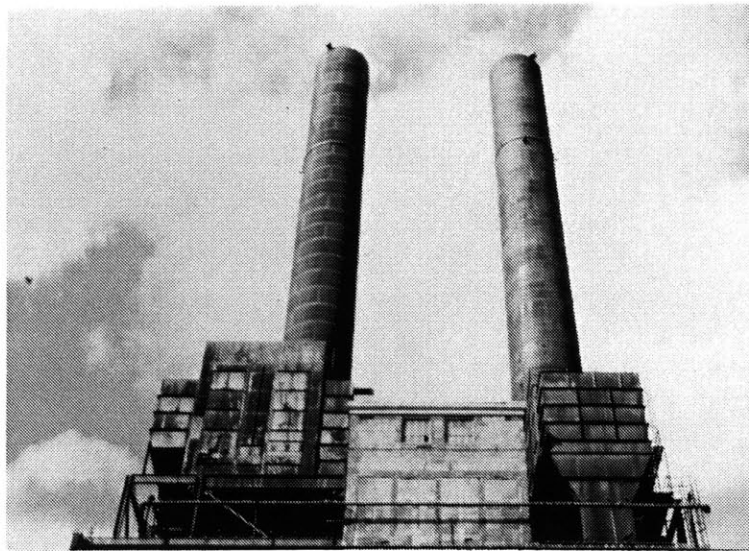


tions.¹ The physical manifestation of this condition is the legacy of jigs and jogs of successive additions and the battlescars of later removals which provide an additional temporal reading of the building.

Lastly, the focus on the mechanics of site and operation are directed toward developing overall form which derives its morphology through use and function rather from external influences. It is not reliant on architectural, linguistic or literary appropriations but rather finds form, and accordingly fundamental or archetypal empowerment, in the technological facts of its construction and operation. Nor does it become a case of exclusively self-referential form as its function and siting are driven by use and its architectural continuity linked by constructed reality. This suggests that solving the "facts of the case" ensure an authenticity of form which goes beyond simple typological convention.

The search for contemporary architectural references for these notions of materiality and clarity of form is not without difficulty. We are typically exposed to two extremes in efforts to reconcile architecture, the technology of architecture and the technology for architecture.

The first, and most common, is an attempt to deny the existence of the technology of the building and its systems. We are exposed to buildings which go to great lengths to convince us that they are made by means other than those actually employed. There are arches which carry no load, bracing connected to nothing, and columns which are hollow shells serving no structural purpose. We see buildings which, as a result of reliance on particular historical styles, are unable to acknowledge the existence of the systems within. Rooftop screens and false Mansard roofs conceal condenser units and fan platforms, transformer vaults and switchgear banks are hidden behind plantings or housed in gazebos. Here, both the creating and sustaining elements of architecture have been subjugated by other, often nostalgic or stylistic intentions.



This is the historical extension of the Beaux Arts notion of classicism which aspired to notions of aesthetic perfection, through symmetry, proportion and other formalistic design means. A consistent melting pot for the appropriation, reinterpretation and transformation of the Classical, Neo-Classical, Mannerist, Baroque and other styles, this tradition, through its rigorous and dogmatic approach found itself unwilling and unable to come to grips with the reality of the Industrial Revolution. Although the changeover to cast iron, and eventually steel construction was made, the resultant architecture was focused on presenting the appearance of a historical continuity when in fact these buildings were concealing one of the most significant changes in building construction and operation beneath traditional limestone or marble facades. Here was a case of architecture being unwilling to keep pace with engineering due to its own inflexibility, a condition which, along with the development of means for solving indeterminate statics problems, set the stage for the schism between engineering and architecture.

In another approach, we are confronted by structural, electrical and mechanical systems to the extent that the architecture seems to be subservient to its components. Exterior ductwork prevents light from entering the building, mega-structures employ redundant bracing and display excessive hardware and connections, the maintenance of a building is sacrificed in the effort to create an alleged architecture of the future in the present. Here the technology of the building has become the parti; the reality of building components comes into question when they enter the realm of decorative elements. It is a case of form-making to support the Machine Aesthetic rather than the aesthetic of machines which creates form through solving a well framed problem rather than appealing to a preconceived convention.

This tradition can trace its route to the inception of the industrial age and the ensuing divergence of the architecture and engineering disciplines. From the early works of Paxton and Burton which set precedent for steel and glass, to the efforts of Eiffel and Dutert which were suggestive of architecture and engineering as heroic acts of a new age there is evidence of two approaches to technology and architecture.



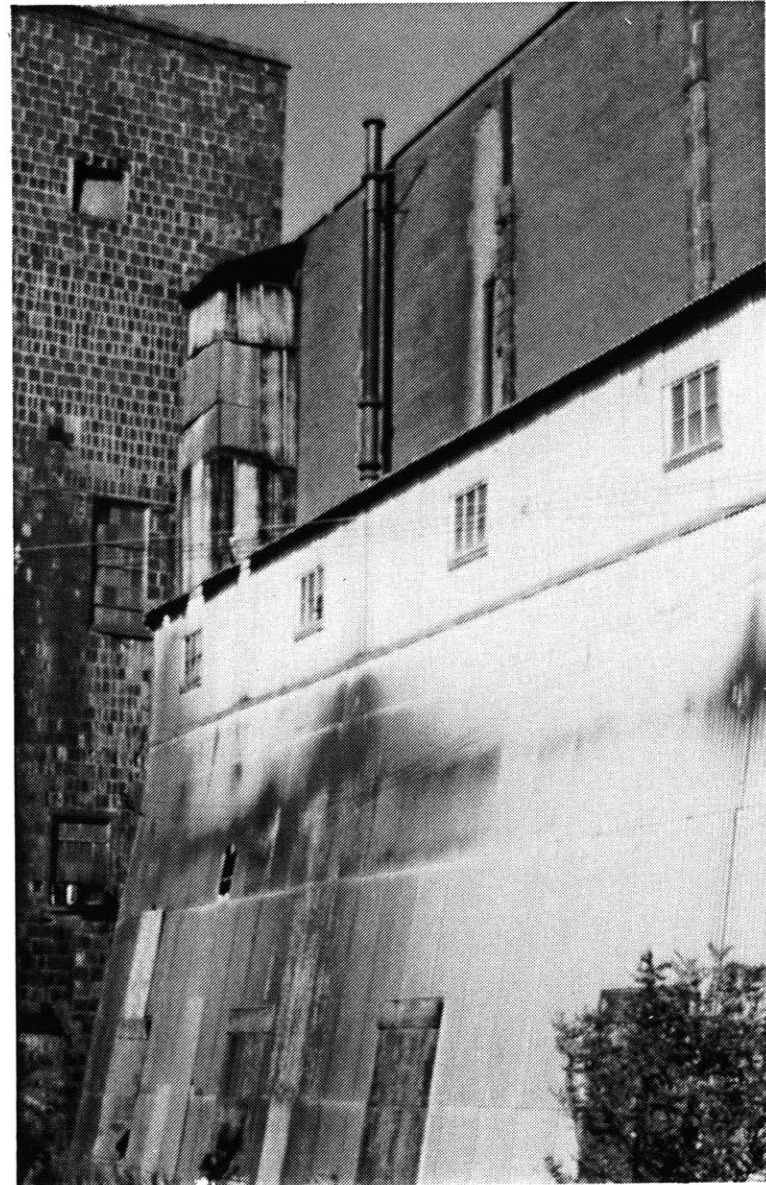


Here we see the focus of form being found in the realm of industry rather than architecture. Though generally unbuilt, the works of the Russian Constructivists and Italian Futurists furthered these notions while imbuing them with romantic, if not somewhat nostalgic, qualities. This tradition of an alternate to the Beaux Arts and Bauhaus traditions remained suppressed with the exception of Buckminster Fuller's work aimed at industrializing the building delivery process which would prove influential to both the Brutalists of the late 1950s and early 1960s. Extending the Brutalist fascination with ultimate honesty in structure and system was the founding high-tech position which found their inspiration wholly in the realm of the technologies of industry. The work of Team 4 and Archigram were an attempt to go beyond the metaphorical Machine Aesthetic of the mainstream Modernist Movement to a literal one of their own.²

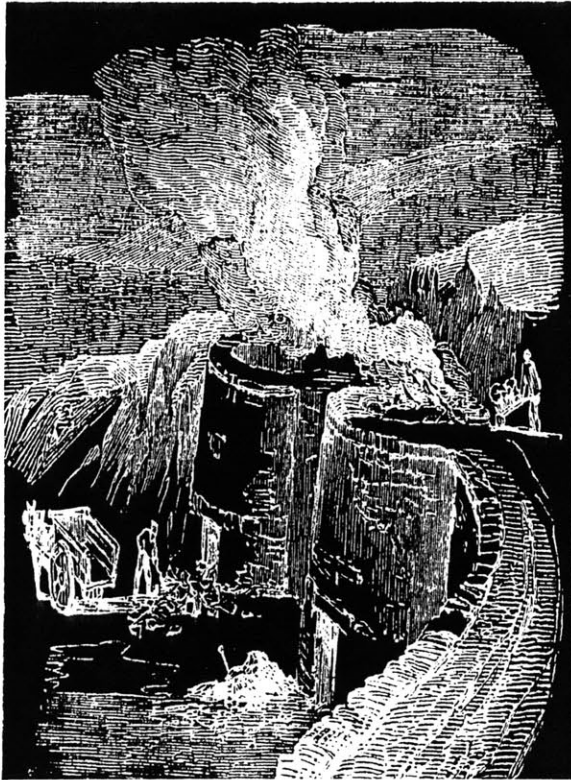
In both these traditions, the will to integrate architecture and technology is absent. Engineering and the Machine Aesthetic dominate in

one extreme, avoiding the lyrical and builderly traditions of architecture. Stylistic or formalistic notions dominate in the other, and resist dealing with the structural, mechanical and operational realities. By failing to reconcile architecture and its technologies, the opportunity for buildings of archetypal significance is lost. The possibility to develop a singular expressive potential is gone. The poetics of construction and materials have been subverted.

It is proposed that a mediating position can be found, one which accepts the technology of building construction and operation. It is a position which seeks an evocative architecture base on the constructed facts of "materiality" and "clarity of form". It is an architecture which is simple but not simplistic, where structural, mechanical and electrical systems are indistinguishable from the architecture. It is an opportunity for ever-changing and authentic sights, sounds, smells, and textures; an architecture of reality, not artifice.



Part Two: Precedent



*See, the many-cylinder'd steam printing-press - see, the
electric telegraph stretching across the continent,*

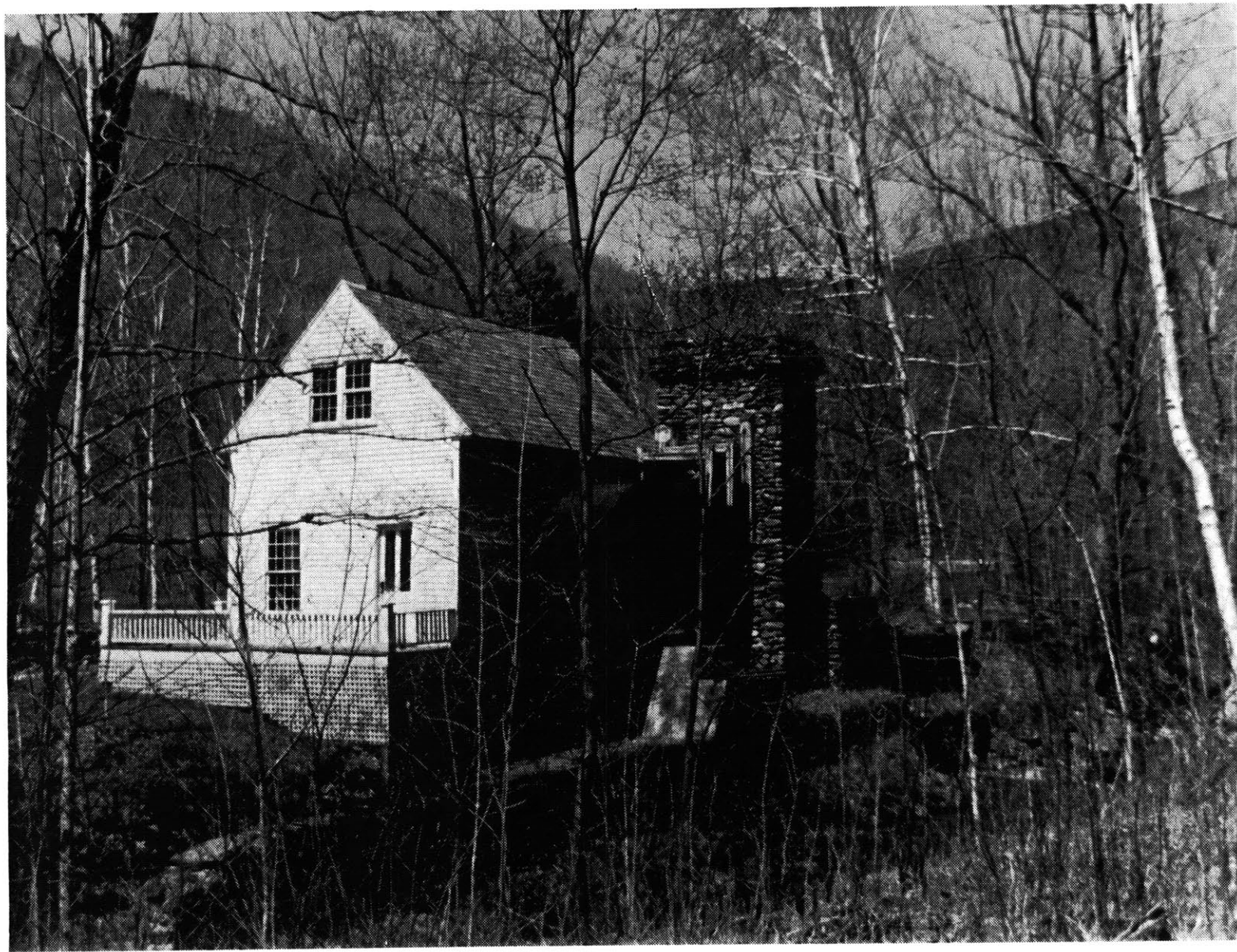
*See, through Atlantica's depths pulses American Europe
reaching, pulses of Europe duly return'd,*

*See, the strong and quick locomotive as it departs, panting,
blowing the steam whistle,*

*See, ploughmen ploughing farms, see miners digging
mines - see, the numberless factories.*

*See, mechanics busy at their benches with tools - see from
among them superior judges, philosophers, Presi-
dents, emerge, drest in working dresses.*

Walt Whitman



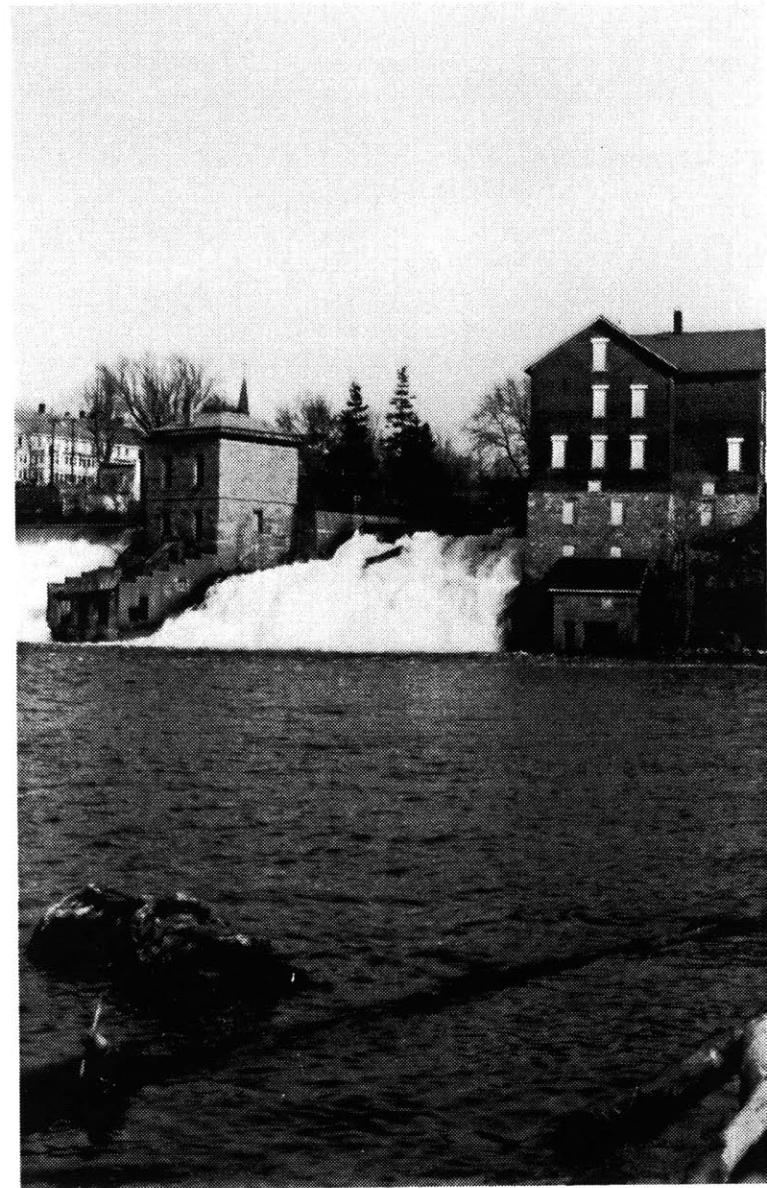


The relationship between technology and the landscape at first appears as one of opposition and irreconcilability. The harsh contrast between an unspoiled wilderness and the rigor of the mechanical vision suggests a complex relationship between man and nature which is defined through this mediating machine. Additionally, it is for the most part a New World, and particularly an American phenomena. A phenomena which contains both metaphorical and physical components. Its lyrical, or mythical qualities stem from its intertwining in American literature and history. Its physical presence contains typological and morphological conditions which are fundamental to the American legacy. Furthermore, there exists the possibility that these notions can be rekindled to provide conditions for architectural and siting decisions today, through an examination of the mechanics from which they derive their form and location.

Due to the singular condition of post-Revolutionary America and its confluence with the beginnings of the Industrial Revolution, the

deployment of technology in a relatively unspoiled landscape was possible. Unlike Europe, whose landscape had been manipulated through foresting, agriculture and industry, America presented its landscape in eager acceptance of the then nascent industrial forces in Europe. This condition, more so than even the euphoria associated with the fledgling republic's new-found independence, would serve to shape and mold the course of the country's history, literature and landscape.

The historical effects of this technology would later prove essential in changing the fundamental vision of the infant United States. Its manifest was clearly rooted in utopian notions of freedom and equality and implicit in this was the extended vision of the rural republic. With the introduction of the industrial age, there comes on the scene the machine as both catalyst and metaphor for the transformation from an agrarian to an industrial society. In this changeover from the Jeffersonian Ideal to the Hamiltonian reaction to it, we are exposed to



one of the most fundamental, if subtle, shifts in the relationship of America to its land. 2

The Jeffersonian Ideal requires some explanation. Though written and disseminated by Thomas Jefferson through various letters and ideals, it would be adopted as the anthem of rural America and present influences which are continued in the present. Firmly rooted in Pastoralism, both ideological and literary, the vision which he put forth was very much one of the individual in the landscape. It was rigorously in favor of self-sufficiency, with each man taking responsibility for his own condition. Implicit in this notion was the understanding that there existed a clear dependence on the landscape for survival. It envisioned man as a "noble democrat" or "husbandman" who lived simply and kindly off the land without avarice and greed; the utopian character for a utopian vision. Lastly, it was pre-emptively anti-European, professing an overpowering desire to maintain a cultural separation which equaled or exceeded the geographic one.³

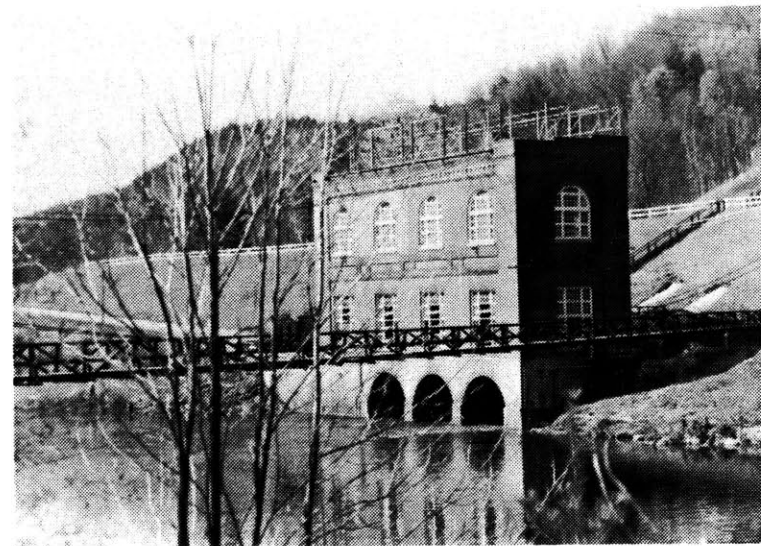
The immediate implications of this position were found in a willful nationalism and rusticism which swept the land. They suggested that America needed to maintain an isolationist position free from the contaminating forces from Europe. There would be no basis here for a drive toward world preeminence. Implicit in their focus was the vague, although important, notion of the individual's "pursuit of happiness", rather than financial gain. They espoused the derivation of education and values from nature in the Lockian tradition. Critical to these implications was the fundamental assumption of land ownership by the individual, this was the key which tapped Jefferson's yeoman into the pastoral and hence, natural, tradition. Lastly, this ideal took a nearly whimsical position toward the technology of the day. There was a ready acceptance of the "little machine", the windmill, the gristmill and other mechanisms which allowed the "noble democrat" some relief from his toils in nature, although this position in no way presaged the thunderous arrival of the Machine Age. The argument could be made that this line of thinking was the precursor to the debate of appropriate technology.



The legacy of the Jeffersonian Ideal continues to this day. It reappears in various forms and can be witnessed in the various conservation movements throughout U.S. history. It appears in legislation such as the Homestead Act and the decidedly rustic flavor of the guidelines for much of the Works Progress Administration projects of the 1930s. More recently it is cited in the "return to the land movement" which peaked during the late 1960s and early 1970s as well as providing some of the grounding for the American environmental movement.

The divergence from this path which took place under the auspices of the Hamilton treasury administration had its roots in the awakening of the American mercantile class to the development and production of new manufacturing techniques in Europe. First articulated by Philadelphia merchant Tenche Coxe, it was the formulation of position which was superfluously based in the realm of the pastoral as a means for defining the conditions by which America could accept and develop the emerging technologies. This position clearly embraced the coming industrialism, reveling in the application of technology in the alleged desire to dispatch drudgery. It suggested a more institutionalized means of administering and overseeing the means by which raw goods were distributed and, ultimately, manufactured. In short, it was more market intensive. Its hero was the dutiful citizen who would operate the machinery, presumably cheerfully, and produce the goods which were to be among the best available. Lastly, it clearly required at least a limited interdependence with Europe, most notably England, in order to develop the technical proficiency to produce the equipment and machinery required.⁴

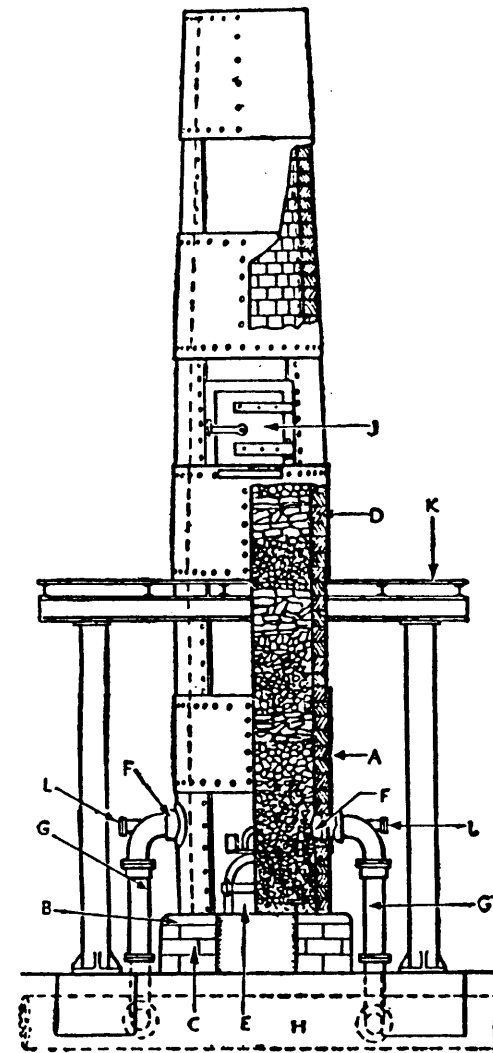
The implications of this move toward industrialization was both economic and political. The notion of isolationism was dispatched in favor of trade links. This, combined with hunger for expansion of both territory and resources would set the stage for the American fixation with Manifest Destiny and its subsequent quest for domination of world markets. Coupled with this is the shift away from the idyllic "pursuit of happiness" where instead the profitability of an enterprise becomes the driving force behind it. While not outrightly

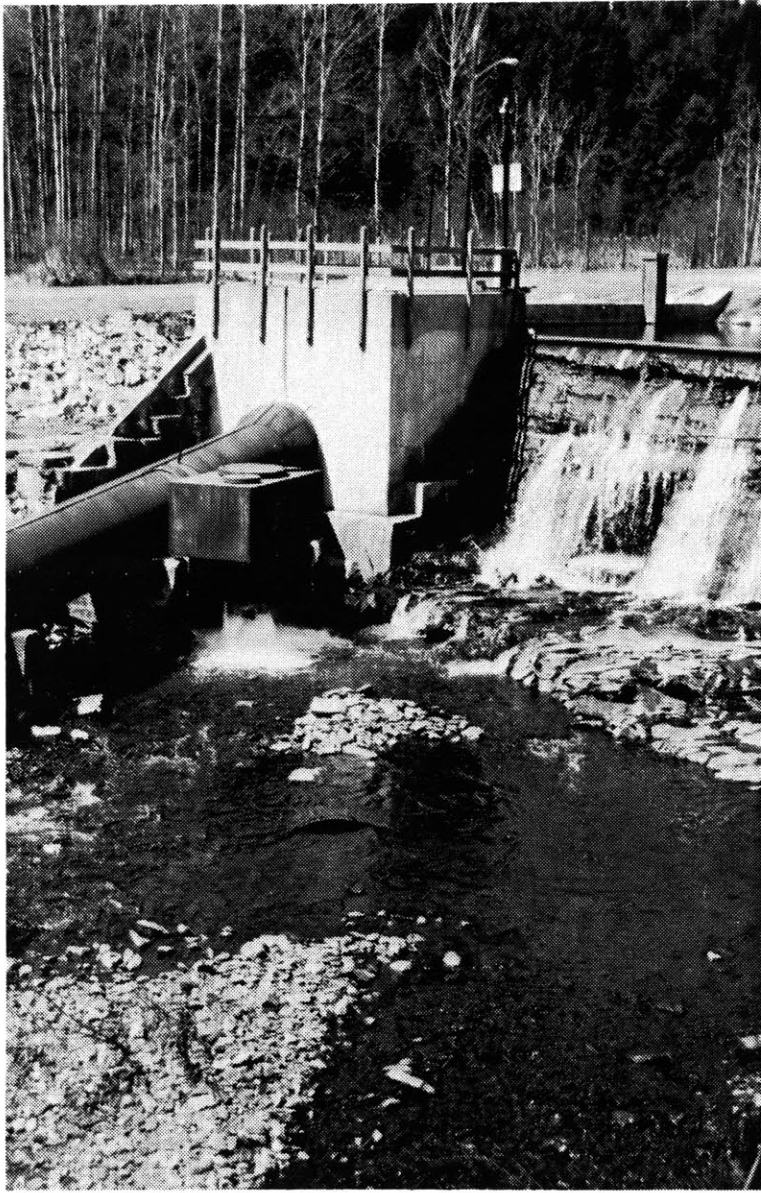




dispatched, the notion of land ownership, and with it the "noble democrat", is suppressed in favor of larger institutions of production. Lastly, the fundamental relationship between man and nature, in the agrarian tradition, has been changed. There exists the first step away from a dependence on nature to a dominance over it.

The fallout from this mandate remains very much with us today. In general, economies of scale have forced increasingly larger means of production and industry, in turn it is suggestive of larger and larger governmental agencies whose mandates are often contradictory. It has produced a physical and psychic separation between industry and the landscape, with few exceptions. The tradition of labor and industry migrating to the source of raw materials has been inverted so that materials are often brought to population centers instead, thus further removing the individual's sense of connection to the land. This inversion has required construction of the most extensive road and rail network in the world, linking cities and by-passing the places be-





tween them. Lastly, it has had the opportunity to create some of the most violent and irreparable environmental damage.

If the historic component of the metaphorical machine revealed a change in the relationship to the landscape, then the literary component in many ways tried to deny it. American literature took on the bizarre task of maintaining the myth of the pastoral while heralding the arrival of the Machine Age. In so doing, these works were to display the nature of this conflict between perception and reality which is still extant. The power of the myth may have been so thorough for two reasons. The first being that in a relatively young culture trying to identity itself, myths are rare. Any myth which is able to sustain itself has the opportunity to assume an immense role in the development of that society. Secondly, the affirmation of the pastoral may have been an unconscious effort at denying its demise. At odds were the particularly American preoccupation with documenting, in wonderment, the natural setting, and the fascination with and the

"heroification" of the machine. As is often the case, the literature of the period was closely tapped into the economic and political environment although with a decidedly romantic and moralistic slant.

One of the first examples of the collision between the machine and nature occurs in Nathaniel Hawthorne's observations in an 1844 essay entitled "Sleepy Hollow", in which he describes the disruption of a contemplative outing by the ferocity of a passing train.⁵ It is the stark juxtaposition which sets Hawthorne to think about this irreconcilable relationship. In the end, he is able to make sense of it all through the heightened experience which is afforded him through this clash. Additionally there begins to be a suggestion that the metaphorical machine is in some way foreboding and signals the end to the pastoral. This theme recurs in *The Tale of Ethan Brand* (1851):



The man who now watched the fire was of a different order, and troubled himself with no thoughts save the very few that were requisite to his business. At frequent intervals he flung back the clashing weight of the iron door, and, turning his face from the insufferable glare, thrust in huge logs of oak, or stirred the immense brands with a long pole. Within the furnace were seen the curling and riotous flames, and the burning marble, almost molten with the intensity of the heat; while without, the reflection of the fire reflected on the dark intricacy of the surrounding forest, and showed in the foreground a bright and ruddy little reflection of the hut, the spring beside its door, the athletic and coal-begrimed figure of the lime burner, and the half-frightened child, shrinking into the protection of his father's shadow. And when, again, the iron door was closed, then reappeared the tender light of the half full moon, which vainly strove to trace out the indistinct shapes of the neighboring mountains; and, in the upper sky, there was a flitting congregation of clouds, still faintly tinged with the rosy sunset, though thus far down into the valley the sunshine had vanished long and long ago. 6

In the works of Walt Whitman and Ralph Waldo Emerson, the juxtaposition appears to be accepted and promoted. In Emerson's Ode (1847) and Whitman's Starting From Paumanok (1855), we are exposed to the suggestion of a dominance over nature, thus leaving the realm of the true pastoral. At the same time we can see the reverence for the landscape:

*'T is fit the forest fall,
The steep be graded,
The mountain tunnelled,
The sand shaded,
The orchard planted,
The glebe tilled,
The prairie granted,
The steamer built. " 7*

Furthermore, the heroic tone of Starting from Paumanok (see page 20) suggests a moral imperative in these acts of altering the land-

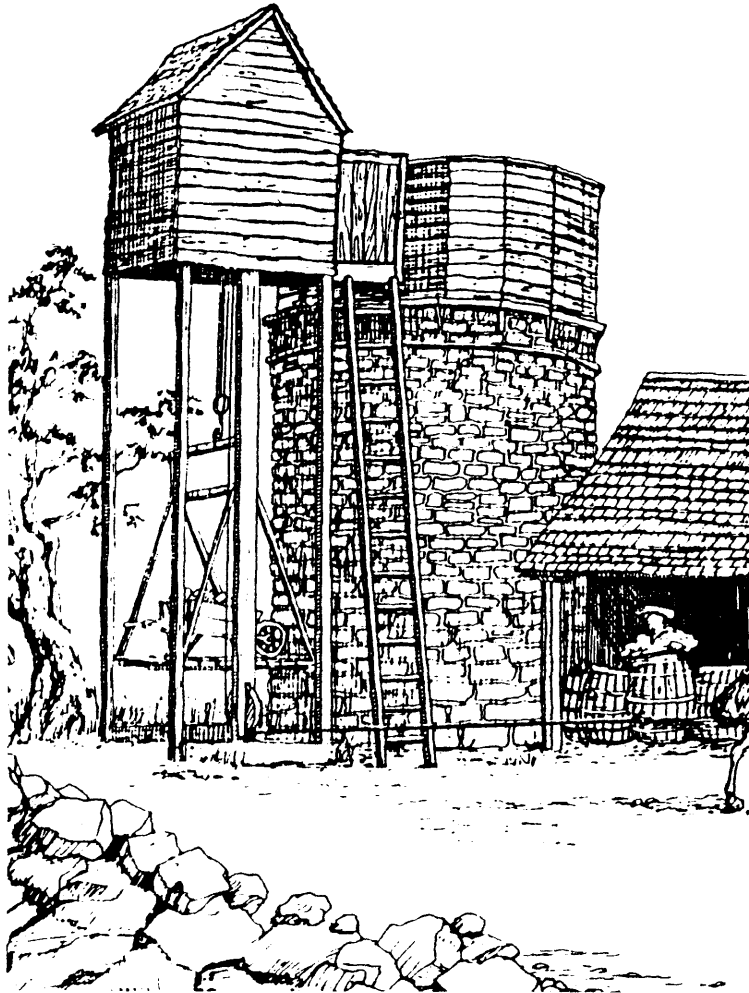


scape. The heroic quality of these actions is overt. The wistful tone suggested by Ethan Brand is absent, the call to charge ahead implicit.

In the same way that the change from an agrarian to an industrial base forever changed the American legacy, the landscape was equally altered. The change from a dispersed, rural population to one of incredible urban density took place over 150 years. For most people the pastoral myth is hollow, the bucolic landscape with which they yearn to identify is only afforded them through television and advertising.⁸ The shift to an industrial economy, as powerful a shift as it was, was still not able to shake the need for the continuity of the pastoral condition. Perhaps it is possible to reconnect to this pre-industrial legacy by authentic rather than nostalgic means. By understanding the mechanics of siting and use, it may be possible to introduce current technology back into the landscape through means which suggest a disruption of nature rather than destruction of it. Within this position lies the opportunity to build in the landscape with a relationship based on interaction rather than dominance.

The pre-industrial machines in the landscape come packed in the romantic notions which can become overbearing in the effort to understand their true relationships to the landscape. While it may never be possible to strip away all of the picturesque, it is imperative to understand that these objects were constructed with a very single minded purpose and, fortunately, are the result of an absence of architectural thinking. In short, they are the singular solutions to a particular set of problems. As the result of this willfulness, they become archetypal in their form yet are varied within their typologies. Specifically, the six archetypal pre-industrial machines which are described herein can be reduced to three types of sources for the mechanical datums from which they individually derive their form. The first is the choice of site, the second is the local siting decisions driven by mechanics of the operation, the last is the use task-driven forms which responds to the needs of the human body in effecting and overseeing these operations. In all cases, the component elements are blissfully simple but the responses to them become enriched through craft, site conditions and available materials.

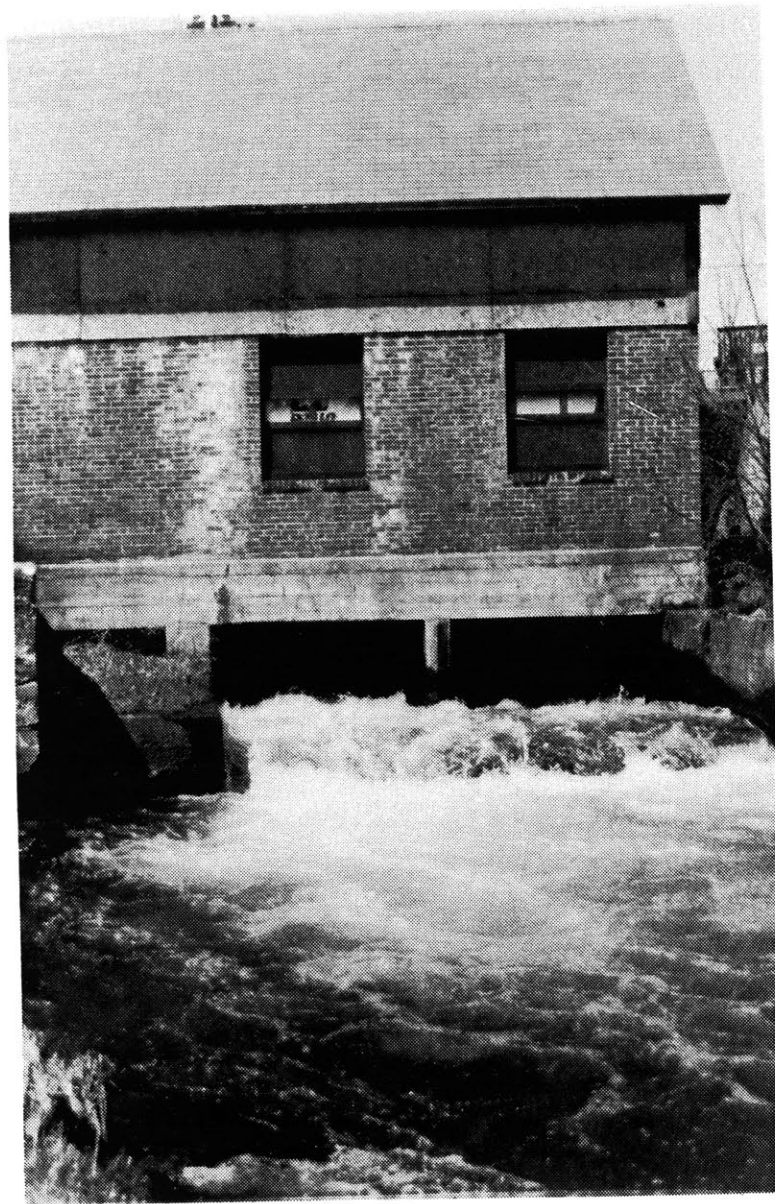




Like all such machines, fundamental siting decisions for the lime kiln and iron furnace came about as result of the need for immediate raw materials as well as supplementary material or site conditions. The lime kilns were reliant on an abundance of limestone for use in producing lime for fertilizer or mortar. Additionally, ample hardwood was necessary to keep the kiln going as many were in year-round operation. It was best if there was a significant drop-off to the chosen site as this would allow the kiln to be loaded from above rather than manually.

The plan of the kiln was circular so as to avoid any areas of uneven heat as well as avoiding any remote corners which could not be reached with a poke. The overall form generally resembled a beehive. The face of the kiln was typically located due north or south so that prevailing westerly breezes would carry away the effluvium away from the tending hole. The tending hole was often set into the great thickness of the wall to provide a vestibule which afforded





some protection from the elements to the lime burner. A large iron door protected him from the intense heat of the kiln. These machines would operate late into the nineteenth century before being supplanted by the perpetual kiln and, ultimately, the contemporary high-output lime furnace.⁹

Perhaps the most easily comprehensible of these fundamental types is the sugarhouse. Its site requirements are simple, it needs to be in or adjacent to stands of sugar maple. Requiring only maple sap and firewood for fuel, it is the simplest of these archetypes. The operation is reduced to boiling water out of the sap by means of a constant fire while protecting the attendants from the elements and allowing the steam to escape. Early examples were basically no more than a cast iron tub covered by oilcloths. As the production techniques improved the form of the houses became more definitive. With the move toward permanent enclosure, and the addition of the identifiable roof monitor, eventually the Vermont "Over Under" would

develop. This sugarhouses took advantage of the sloped terrain of most maple stands by building out off the hillside to create a larger, and continuously accessible fire pit below the boiling tub. The boiling level was reached from uphill and the intermediate floor protected the attendants from the smoke and flames below. Perhaps it is this simplicity, combined with relative difficulty of the tapping and sugaring processes which permitted the sugarhouse to be one of the few of these types to remain unchanged.

The last two examples of these fundamental types are the most important in the context of this investigation, as the resulting design project shares many of the siting conventions and mechanics. They are the sawmill and the gristmill. Site selection and resultant tasks are the main areas of difference between the two. The gristmill needs proximity to grainfields, the sawmill to timber stands or, as an alternative, a means of delivering wood. While their functions are significantly different, they share siting and operational mechanics which

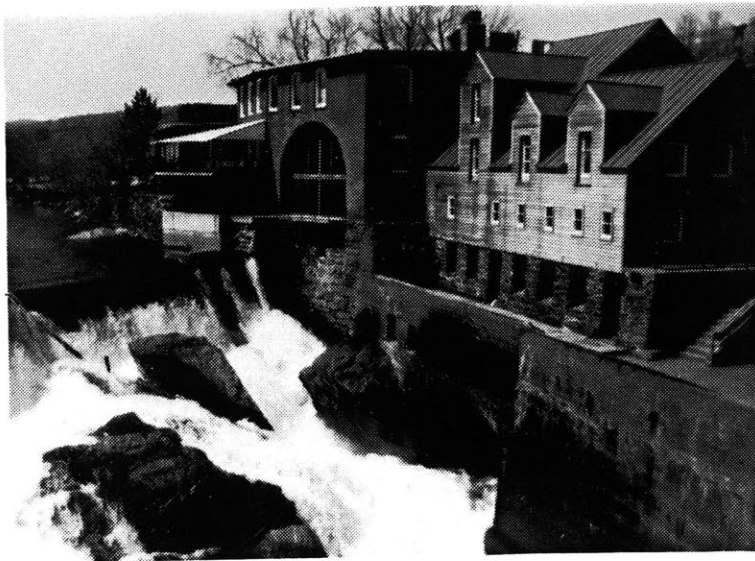


makes them inseparable. For the purposes of this examination they will both be treated under the more generic mill typology.

The primary siting considerations for the mill are adequate flow and head to accomplish the tasks at hand. Flow is the amount or rate of water which a stream carries at a given time. Head is the amount this water drops at the point in the site being considered. Both combine to determine the feasibility of waterpower for the proposed task. The conditions which allow the mill to be built are also those which may ultimately destroy it. As the streams and rivers which supply the power to the mills are dynamic and seasonal, they require a unique physical response to this siting dilemma.

The tradeoff is in the distancing of the mill from the water. The difficulty of bringing water to a more remote mill must be weighed against the risks associated with building in this "danger zone". There are numerous examples of mills for which that gamble was a loss, many have been swept away by cresting floodwaters or winter ice jams. Indeed, it is the caprices of the running water which most determine the form of the mill. With the exception of the rare, all stone mills, the typical mill consists of a massive stone or concrete base which is constructed to withstand the most violent of surges. Atop this base is constructed the millhouse which is generally an enclosure to protect the works below. The fundamental "fact" of the mill becomes this lighter, more fragile superstructure which perches precariously atop a permanent landscape piece. Like the "fact" of the tree growing atop a riverside boulder, there exists simultaneously two conditions, the temporary and the permanent.

It is important to note the extreme variations in mill construction result from variations in site conditions and available building materials. They are linked by their operational and site mechanics although the technologies employed to achieve those mechanics may differ significantly. It becomes understandable that the form is generally independent from the technologies being employed. There are numerous examples of mills being refitted, in some cases as many as four different times, with new and upgraded works. The now-defunct



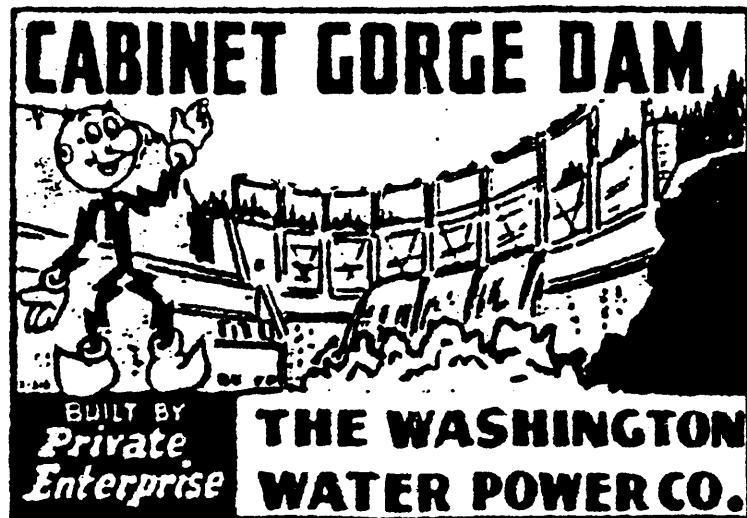
Frank J. Moors sawmill at Wilton Falls, New Hampshire originally was powered by undershot, then overshot waterwheels before being finally refitted with a wooden tub turbine in the mid-nineteenth century. Today even the most sophisticated small scale hydroelectric facilities share these same mechanics. While the efficiency of the turbines may have increased tenfold and the durability of the works doubled, the same fundamental mechanics of site exist. It is this continuity which ties together the new and the old.

The mechanical continuity of the small scale may be very much intact, but the state of the mills, and, in particular waterpower (hydromechanical as well as hydroelectrical) is suggestive of the two divergent paths discussed previously. There has been considerable effort made to revitalize many of these mills throughout the Northeast. At the same time the development of large scale hydropower has increased significantly. With very few exceptions, the opportunity for current, small scale waterpower facilities has been missed.

Many have vanished, some are in ruin and a few have been refurbished, but the mill archetype remains a powerful icon. In Queechee, Vermont the Simon Pierce glass works has taken an old waterpowered textile mill, rebored the penstock, and installed a new generator and turbine. North, in Warren, an old sawmill has been refitted as a house, its diversion dam repaired, its penstock and turbine replaced. In both cases they are entirely self-sufficient in terms of their electrical consumption and, in fact, are able to sell their excess electrical output back to the local utilities at market rate.

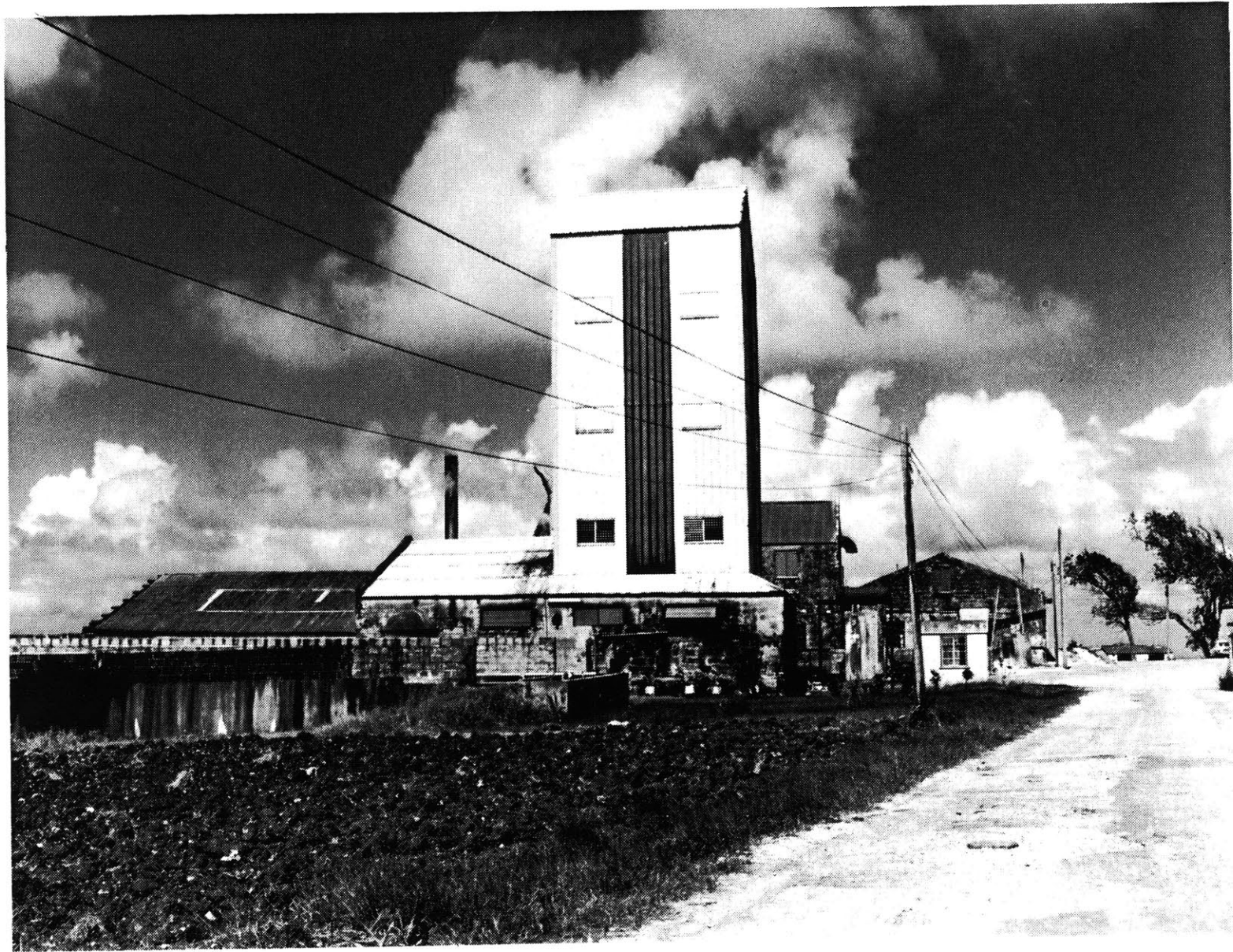
Further north, in Canada, the HydroQuebec project stands in stark contrast to these small scale endeavors. Native American settlements and thousands of acres of virgin forest have been destroyed in order to produce hydroelectrically generated power which is then transmitted to the insatiable Northeast power grid some three hundred miles away. In Erving, Massachusetts, Northeast Utilities has developed a system where they electrically pump 666,000,000 cubic feet of water out of the Connecticut River (to a holding reservoir some 920' up Northfield Mountain, through a tunnel which required the excavation

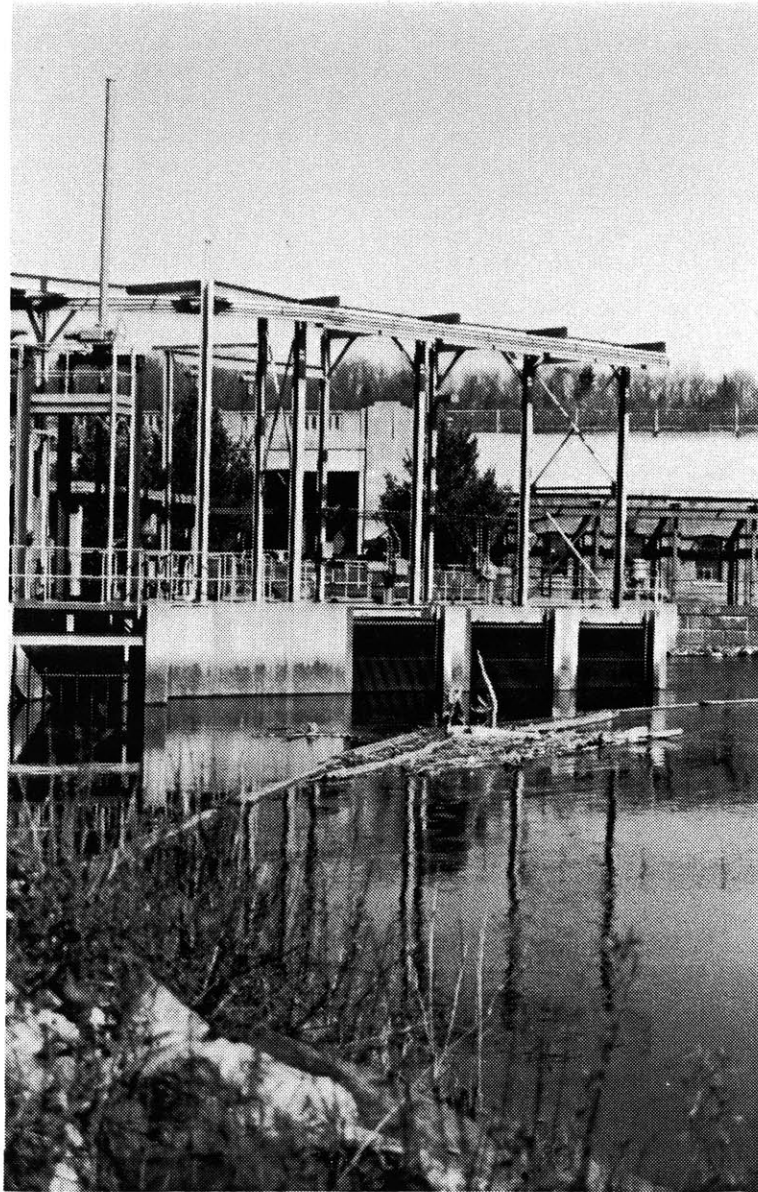




of 1,4500,000 cubic yards of granite) during hours of low electrical consumption. 10 Later, same water is released, through turbines, to the river during hours of high electrical consumption. The birthright of both these projects is in institutional and centralized energy policies.

There is evidence of profitable and efficient use of small scale hydroelectric generation today. In Vermont, Green Mountain Power is able to maintain some eighty sites despite a policy of not building in waterways with significant fish populations. There are numerous small turbine manufacturers producing relatively inexpensive equipment and the U.S. Department of Energy has volumes of information available on the means to develop small scale hydroelectric generating stations. The water rights issues, particularly in the western United States, seem to be the restrictive forces on the application of these technologies.





In conclusion, the position that the mill archetype can be revitalized is put forth. This implies not a revival of a picturesque condition but rather a return to the very real "facts of the case". Inherent in this position is the possibility of tapping into the power of the Jeffersonian Ideal. It is not to suggest a perpetuation of the pastoral myth, but rather that some of the components of that myth are real and compelling. These components are the re-establishment of a direct connection to the landscape through operational structure, a re-affirmation of land use by private rather than large scale institutional interests, and the conviction of self-reliance.

The physical implications of this typological revitalization do not involve the re-use of primitive technologies or traditional materials, but rather suggests applying the same rigor of solving the problems fundamental to the siting and operational conditions. It compels the investigation of these problems using current, and comprehensible, scientific knowledge and construction means. It is suggestive that

form can be derived not solely from small scale functional issues, but primarily as a response to the mechanics of use and nature.

The social and economic implications derived from the Jeffersonian legacy suggest a condition which is less about the connection to institutions and more about the physical, as opposed to metaphorical, connection to the land. It may very well contain sentiments which are in opposition to large scale government and industry though probably not to the point of sedition. Furthermore it suggests that the re-establishment of the direct connection to the land may create a more tenuous existence, one where the risks and fortunes are more intimately connected to the manner in which the landscape is utilized.

It is from these groundings, the notion of fundamental mechanics and the tradition of self-reliance, coupled with a clear position on the integration of technology and form-making, that the machine in the woods comes to be.



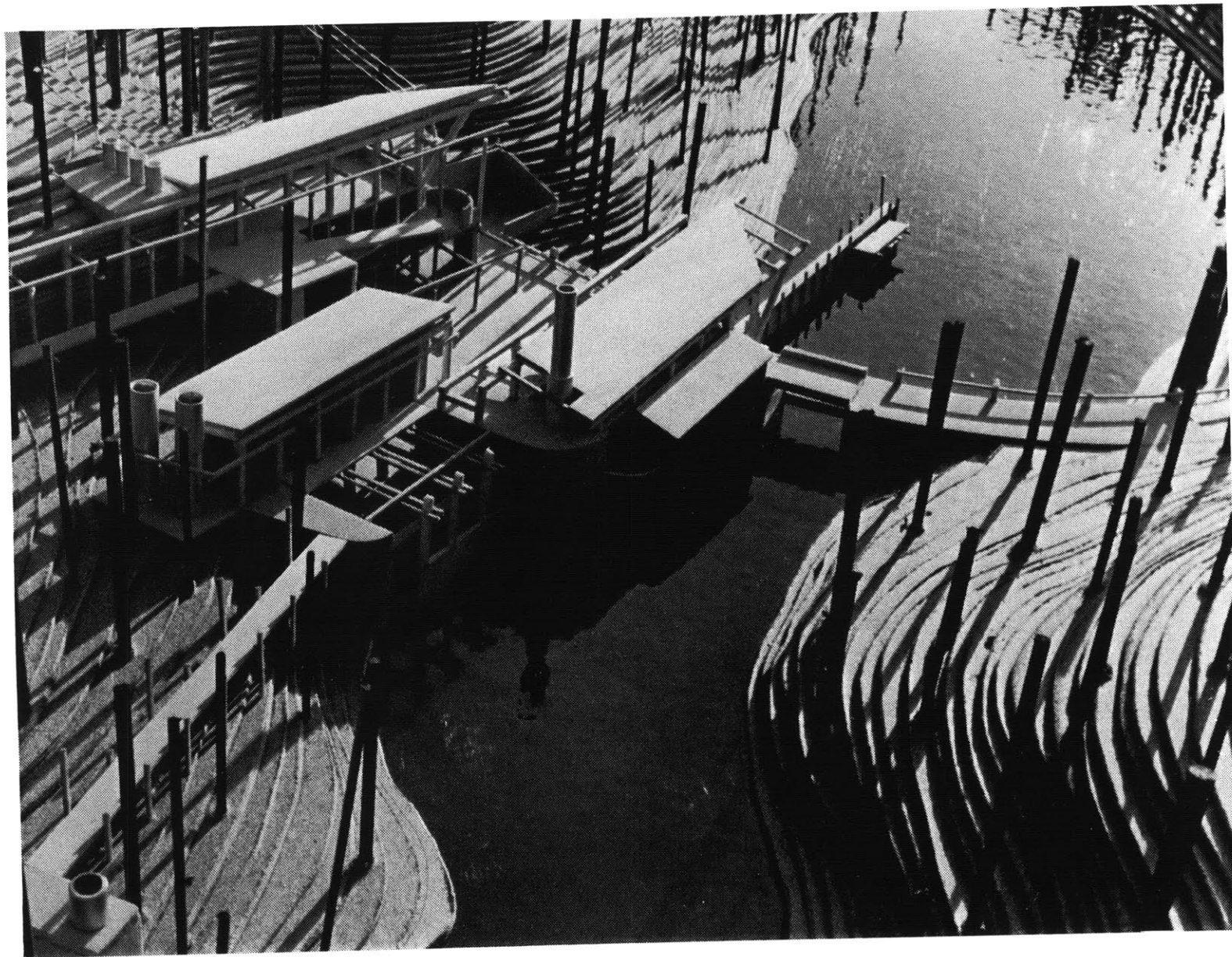
Part Three: Project



*For a good decade
The furnace stood in the naked gully, fireless
And vacant as any hat. Then when it was
No more to them than a hulking black fossil
To erode unnoticed with the rest of the junk-hill
By the poisonous creek, and rapidly to be added
To their ignorance*

*They were afterwards astonished
To confirm, one morning, a twist a twist of smoke like a pale
Resurrection, staggering out of its chewed hole,
And to remark then other tokens that someone,
Cozily bolted behind the eye-holed iron
Door of the drafty burner, had there established
His bad castle.*

W.S. Merwin





The Connecticut River, in flowing south from its headwaters in Southern Quebec to its destination in Long Island Sound, picks its way between the White Mountains of New Hampshire and the Green Mountains of Vermont. As it enters Massachusetts, it finds itself dividing the Berkshire foothills from the southern flank of the Pisgah Mountains. Amid the col created by the five peaks defining this flank is a small, but deep, lake fed by runoff from the surrounding slopes as well as two underground springs. This watershed feeds five streams which fall some four hundred and fifty feet to eventually meet the Connecticut.

The largest and most powerful of these, the Louisiana Stream, leaves the lake and tumbles down through the westernmost ridges of Louisiana Mountain to the headwall of the Louisiana Gulf, a steep ravine running almost due west before ending at the fertile meadows above the river. The stream forces its way through the gulf, carving away at its face, leaving only large boulders and fallen trees to define its

banks. It drops nearly one hundred seventy five feet as it crashes through the three quarter mile long gulf then moves on, passing under a small highway bridge to the Pauchaug Meadows below. Here it finds gentler terrain and, accordingly, begins to rest, gently emptying itself into the wide river below.

Along the length of the gulf there are remnants of past efforts to inhabit it. At the head there are the remains of a stone diversion dam which most likely was used to create an ice pond. Nearby, cut into the south wall of the ravine are several ice houses which take advantage of the relative shade and coolness of the gorge. Further down, at the head of the largest falls there is the remains of an old undershot waterwheel; the wheel is long gone and only the worn wooden axle and rake blocks remain. Moving down the stream are the remnants of a pump house which was used to provide water to the nearby campus and houses during the 1920s. The concrete foundation and piers are all that remains with the exception of the twisted, rusting metal



embedded in the floor of the ravine downstream. The enclosure and works were swept away as a result of the flooding associated with the Great Hurricane of 1938; the nearby Miller's River cresting to eighteen feet above normal and a host of weirs and sluice in the areas were destroyed. A mostly overgrown dirt road reaches the base of these ruins from the highway below by transversing the north slope of the gulf.

The northern wall receives a strong, though filtered, southern light and supports varied growth. White and silver birch, oak, maple and other deciduous trees all flourish. There is an abundance of sassafras and other lauraceous growth which flourish on the gentle grade. Smaller perennials add to the richness of the north slope. In spring and summer the wall is awash in the green of new growth. As autumn takes hold, the yellows, oranges and fiery reds appear in the spectacle which is New England foliage. Later, the leaves drop leaving the floor of the gulf awash in reds and browns awaiting the first snow. A typical winter will leave three or four feet of snow in the ravine; the northern wall glistens in the winter sun. This light is reflected back through the barren trees to illuminate the southern slope.

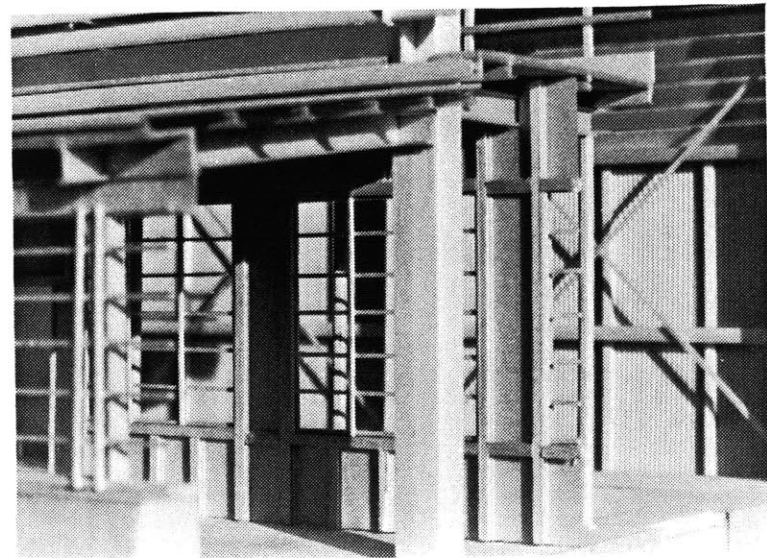


By stark contrast, the southern wall remains as a datum by which the temporal nature of the northern wall is perceived. Supporting mainly old growth coniferous trees which stretch skyward due to the absence of direct sunlight and the extremely steep slope, it is far less inviting. Except to traverse, the deep layers of fallen needles and the extremity of the grade make travel by foot all but impossible. The seemingly endless tree trunks headed upward dictate movement and remind one of the severity of the slope. The dark green canopy above shuts out much of the light from above. The limbs of the spruce, fir and pine tower overhead leaving a cavernous space below. The slope is punctuated by the random splash of sunlight which has managed to poke through the covering above, adding to this is the horizontal glow from the northern wall which softly washes through the trunks to illuminate the slope in seasonal light.

Just above the midpoint of the ravine there is a small falls which occurs at the head of a swale in the south slope. Traversed by the remnants of an undershot wheel, the stream crests and then plummets some thirty feet over boulders before continuing on. There is some relief in the south slope as a small bowl is formed by the natural castellations of the mountainside. An existing foot path takes advantage of the easing of the grade and eases along the south slope to some large rocks which makes crossing the brook possible. This path then continues across the north slope eventually reaching the meadow and river beaches beyond. At the base of the bowl, adjacent to the path, there is a protruding knob of land over the falls which offers a view westward out of the gorge. It is here that the machine has been built.

The machine is built here to take advantage of the head available at the falls rather than the vista which is present. The primary intervention into the landscape becomes the dam, its presence necessary to retain the rushing water and, as it stretches across the gulf and turns westward, the land as well. It must act as both a diversion and release dam, allowing the majority of the water to pass on to through to the bottom while ensuring that there is sufficient energy available to power the machine. This is accomplished through the installations of continuous flashboards across the throat which can be operated manually to ensure maximum head at times of low water and maximum release at times of high water. The dam's width is determined by the need to bring traffic across it as it has links to an extension of the existing dirt road to the west. Its structure consists of a series of massive, interlinked concrete cells which form the curve and, through their width and weight, are able to resist the overturning moment of the water and earth beyond. Atop the dam, spanning the release throat, is a small steel Bailey bridge, most likely U.S. Army surplus which allows passage over the water to the concrete mat which is set into the hillside.

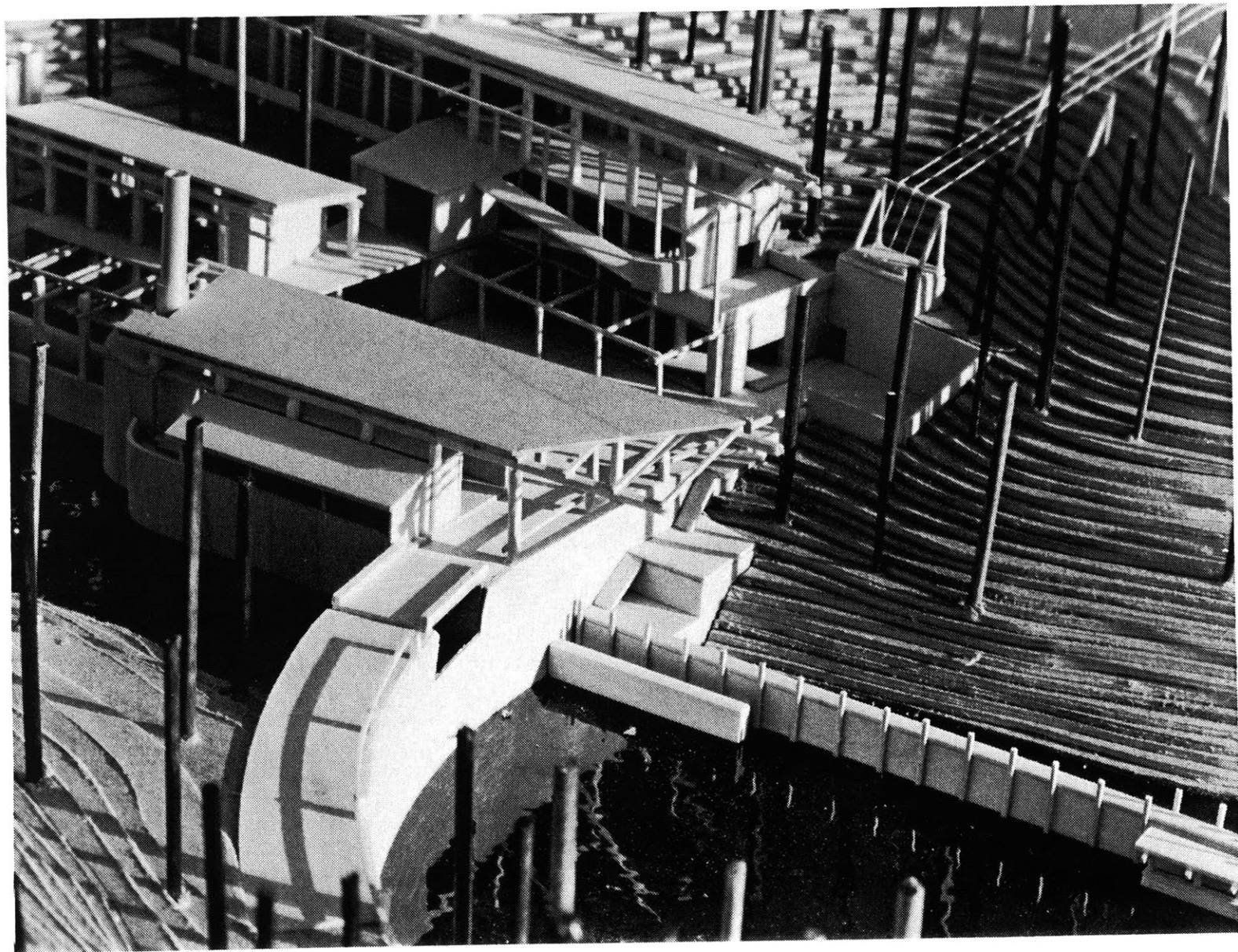
Integral to the dam are the waterworks and hydroelectric configuration. The water is brought into the machine upstream at the forebay. A series of massive, curved shields protect the inhabitable areas from





the danger of ice jams during winter or dead wood being carried downstream during spring flooding. At the entrance to the forebay, the first of a series of steel trashracks keep the loose wood and other debris from continuing on into the machinery below. At the second set of trashracks, the water is brought into the penstock, an eight foot diameter steel tube set into the foundation. The tube is lined to reduce frictional losses. Flow into the penstock is regulated by a series of manually operated valve gates based on the seasonal or daily flow of the stream.

The water continues through the penstock and turns downward to the turbine frame. A Banki-Mitchell Turbine is mounted in the frame which sits on rails atop the tailrace walls. It, in turn, is connected to a series of transfer gears which turn the five hundred kilowatt generator above. Rough estimates indicate that this would allow the generation of roughly nine hundred eighty thousand kilowatt hours per year. This electricity is carried out through the switchgear room and



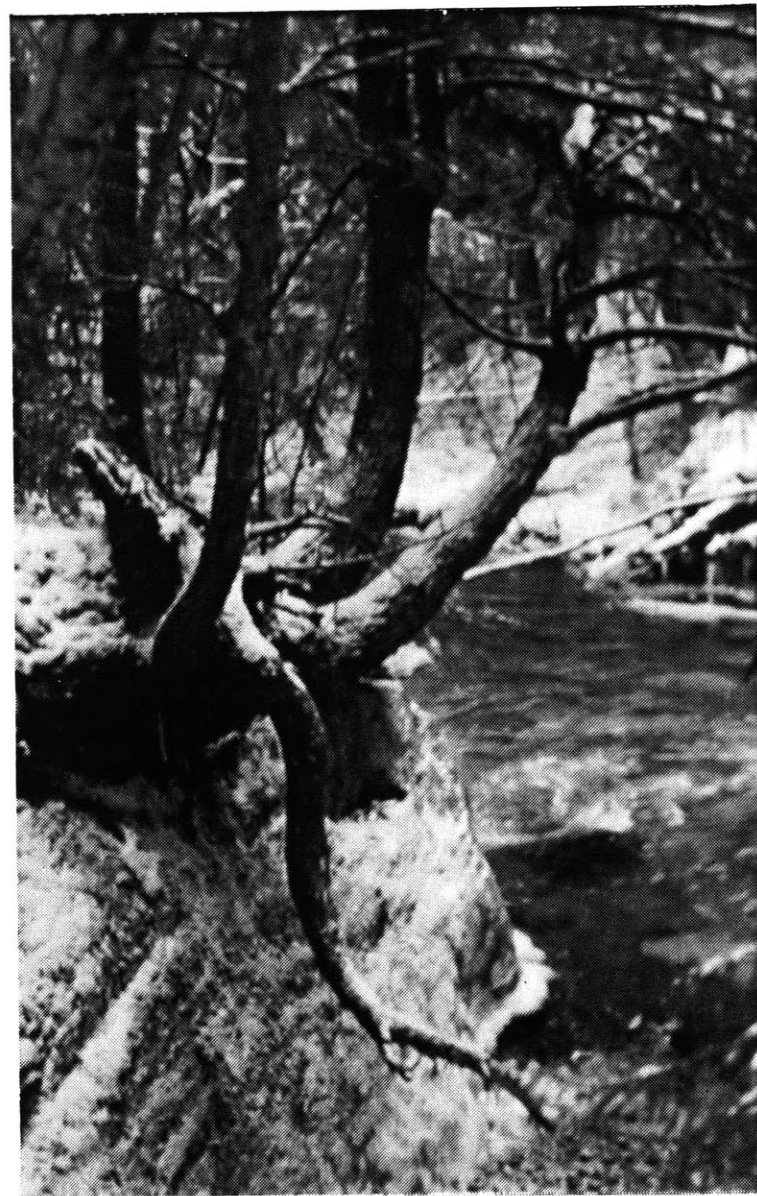


transformer vault where it is again switched for on and off site use at the transmission platform. After passing through the turbine, the now aerated water continues out through the tailrace to join the original flow in the outlet pond below.

This outlet pond has been created as a fire pond due to the relative inaccessibility of the site and the absence of existing firefighting systems. The high risks associated with the furnaces and kilns at the site and the abundance of naturally combustible material demands that some action be taken. A high pressure sprinkler system services the foundry, pottery studios and glass blowing studios, providing protection while allowing an unprotected steel structure. Several fire hoses are distributed throughout the site as well to guard against fire on the site or in the surrounding woods. Both of these systems share water which is electrically pumped from a stand pipe which draws it from the base of the pond.

All of the studios have been offset in a general west to east configuration due to the issues of toxicity associated with the project. The physical definition of the ravine controls air movement and nearly assures west to east airflow based on the prevailing westerly and southwesterly wind patterns. For this reason, all of the exhaust stacks have been offset along the west east axis with the discharge always occurring to the east of the inhabitable spaces. The most toxic of these discharges, those from the foundry and raku kilns, have been further offset to the north to promote dispersion of heated air and smoke, respectively, to the center of the gorge and up, and away from inhabited areas. The raku kiln has been moved some one hundred twenty feet further to the east to ensure that its particularly smoky and noxious fires are not transmitted back to the main complex.

The incorporation of the existing footpath connecting to the campus in the uphill direction, and the river in the downhill direction has

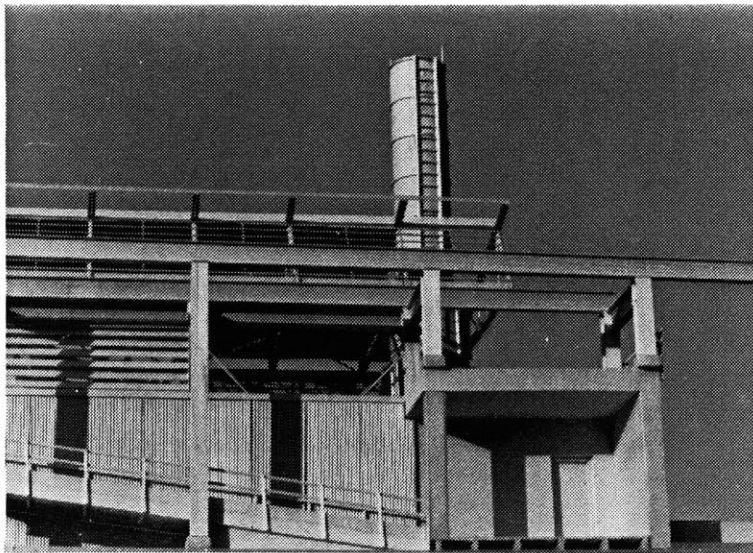


affected the orientation of the southernmost components of the site. This path will also become the main means of entry to the site, where foot traffic will enter from above and behind the main orientation of the site. In order to solve the problem associated with the steep grade a cut has been made across the face of the south slope allowing a reasonable passage into the ravine. A wall of sheet piles with an exterior structure holds back the earth as well as allows for a secondary structure which supports a pedestrian bridge by which one enters the complex.

The mechanics of the site and the response to the landscape are not the only scale by which the complex is understood. Structural, programmatic, spatial ordering and operational mechanics also define the form in readily understandable ways.

Attached to this hillside mat are a series of lightweight steel enclosures which constitute the studios and workshops for the center. The structure for these and the dam/foundation are instantly apparent as the primary structural elements are visible in all cases. At the foundry, for example, the oversized columns are indicative of the structure being designed for the gantry crane above rather than any conventional gravity loads. The series of lateral moment frames which run the length of the foundry serve both to stabilize the steel frame for the dynamic crane loads as well hold the forklift ramp from the delivery bay to the charging platform. Both of these tasks are instantly recognizable through the exposure of this mediating structure along the length of the shed.

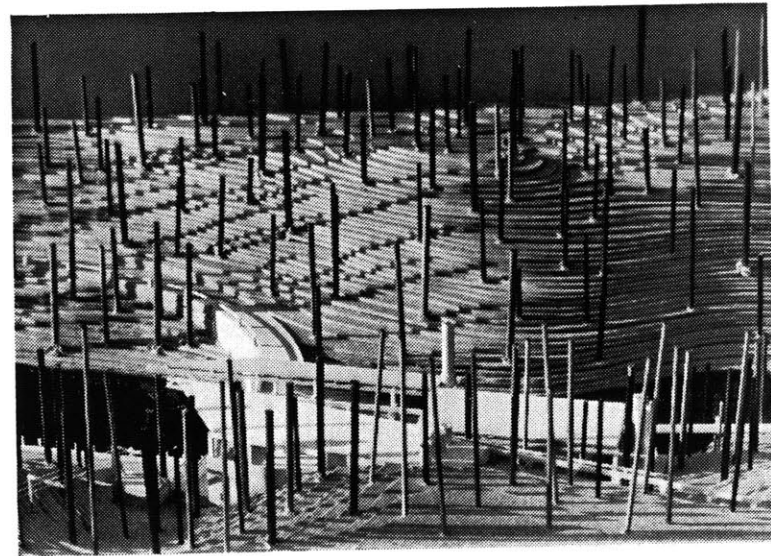
The programmatic facts of this complex are readily understood by its composition. The main components of foundry, ceramics, assemblage and glass studios are each rendered as individual entities. No efforts have been made to combine them into a singular assembly. While similar in construction and general arrangement, the programmatic requirements of each differentiate them. This differentiation is reinforced sectionally where the vertical connections of ramps and stairs define the vertical zones, and, combined with the material and constructed variation, enforce a reading of these as programmatic

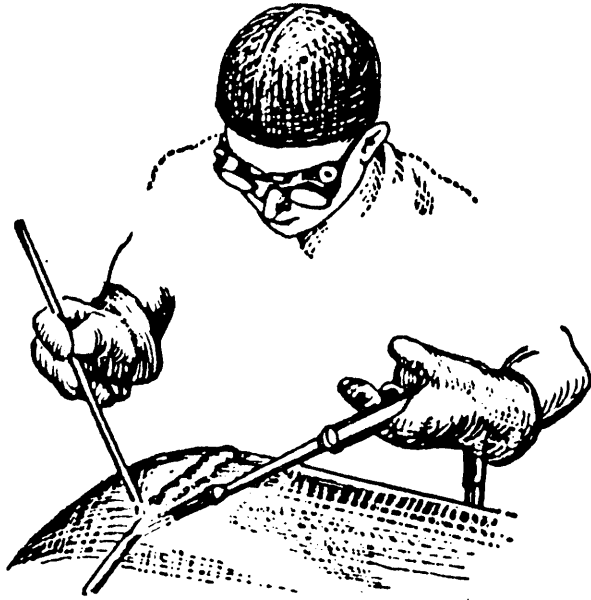


components. Different use zones within these sheds suggest the varied nature of the programming of each. The ceramics and pottery shed contains the main studios below and the gallery/classroom on its upper level. The continuation of the real ground plane of the earth through to the gallery level serves to mark the separation of program over and under. This separation is again enforced by the continuation of the lower level outside to meet the forebay enclosing walls. Here, we have the reading of two ground planes in the building reinforcing the programmatic facts of that building.

In all three components the simplicity and readability of the structure invites addition, modification or removal of it. At the foundry, the chasing studios exist as a mediating space between the main casting hall and the outside. Spatially and structurally this is accomplished by means of the imposition of a secondary system which both encompasses and expands on the primary systems at work in the shed. The complete exposure of the retaining wall structure, the steel frames of the assemblage area and the exposed moment frames along the foundry all suggest ongoing construction. Although the complex may be complete at the moment: this condition invites subsequent modification or removal of these systems.

The operational mechanics of the complex also give order and form. The need for maintenance access to the turbine and generator requires that they can be removed from the bottom of the waterworks. This requirement suggests that some type of mechanism for their removal be provided. The need for a crane in the casting hall of the foundry provides the possibility for sharing this mechanism. By locating the foundry over the waterworks and turbine frame and extending the foundry structure out and over the wall of the dam, this possibility can be realized. Another examples lies in the addition of the forklift ramps. Their location in the mediating structural zones of the glass studio and foundry begin to suggest a continuity of movement through the complex, a continuity which is need driven rather developed in architectural terms. In both of these examples the need to move heavy objects and materials has set the conditions of form-making and, secondly, architectural understanding.





At a smaller scale still, the means by which these buildings are constructed begins to reinforce some of the overall intentions of it. The methodology and use of materials, the scales of those materials, the degree of fabrication which they require and the means by which they age all participate in defining the sense of place.

There is evidence of a desire to choose construction methods which utilize the most direct material qualities of all components. Materials and methods which get the job done, do it without pretense, and show how it was done, are preferred. Galvanized, corrugated steel roofing is used as roofing, metal siding as siding, and glazing is kept simple and straightforward. Everything is as it appears, these are not ideas about the thing but the thing itself.¹¹ In all cases the effort has been made to use materials as they are meant to be used and, in so doing, to show how they are used.

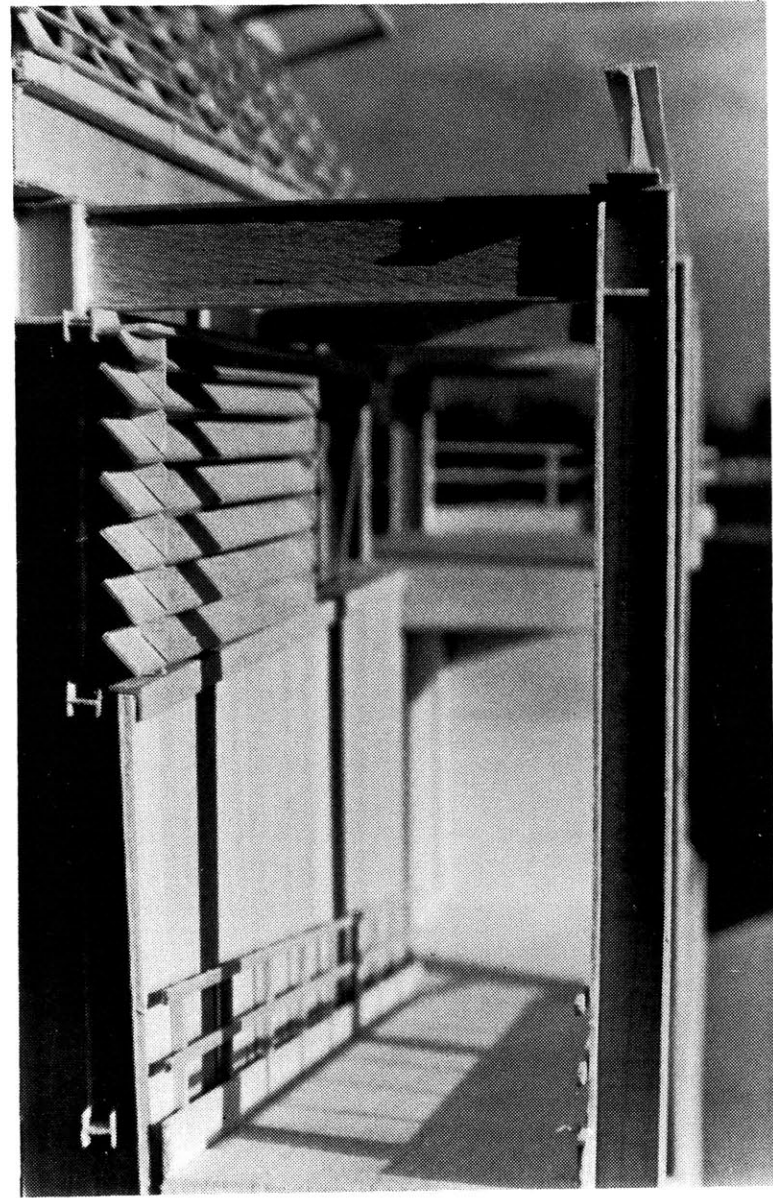




Allied with the emphasis on material qualities is the effort to utilize material which can participate in more than one scale. This is an attempt to connect the project to the three most perceptible scales of building: the environmental, the anthropometric and the tactile. Materials which have dimensional richness can often participate in two or more of the scales. The carriage beams for the gantry crane stretch some one hundred twenty feet from the cupola base to the overhang above the tailrace. The continuity of the flanges over the three forty foot sections provides the dimension reading at the site level by providing a horizontal datum against which other components can play off. The two foot deep section provides the mediating or human scale dimension while the beam splices, themselves smaller, bolted connections, participate in the scale of the hand. The opportunities for further material scale definitions are presented in the overlap of multiple materials which yield a variety of dimensional and spatial conditions.

These structures take their technological stand in the builderly tradition. They are allied with neither the notion of pre-manufactured assemblies nor with the realm of the "one off" custom designed component. Instead, they utilize components in their root sense, as fundamental building blocks which are combined, through craft rather than manufacture, to create assemblies in the field. They are "off the shelf" in the sense that they are made up of standardized parts, but in no way do they begin to suggest the acceptance of the factory finished, value-added assembly. They are explicit in the way they are assembled.

This is evident in the construction of a typical foundry bay. The H section columns are bolted to the reinforced concrete curb through grout pads which are used to level and align them. Small W section gerts connect to them as do two diagonally crossing steel rods to give lateral stability. Atop these gerts, vertical corrugated siding rises two thirds of the bay height before being capped off by a Z channel which

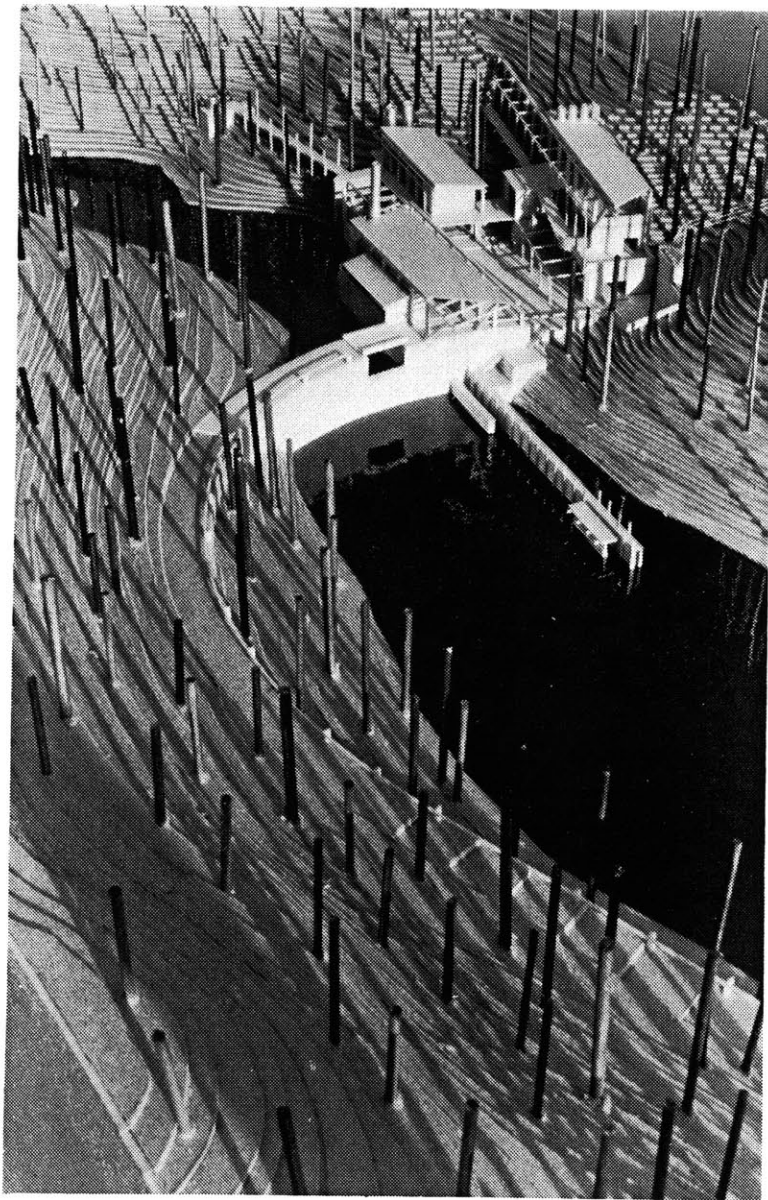




provides a safer edge condition while providing a drip edge of sorts. A last gert stands alone above the siding to receive the rainwater off the clerestory above and bring it out to the leaders further down the foundry. It is clearly an assembly of parts not products.

Materials have been used which require no additional field finishing, they are allowed change due to exposure and use. Galvanized steel siding will darken and pit with age. Structural weathering steel will turn orange, then brown and finally deep purple as it oxidizes. Standing seam metal roofs will soften and lighten with age as the sun beats down on them. Exposed concrete will bleach and eventually take on the memory of the compounds which come in contact with it. Flux, clay, motor oil, paint, pottery glazes will all leave their marks. Mosses will begin to grow in the moist and dark portions of the concrete sluices and forebay and lichens will follow above, in the sunlight. The tempering of the machine has begun.





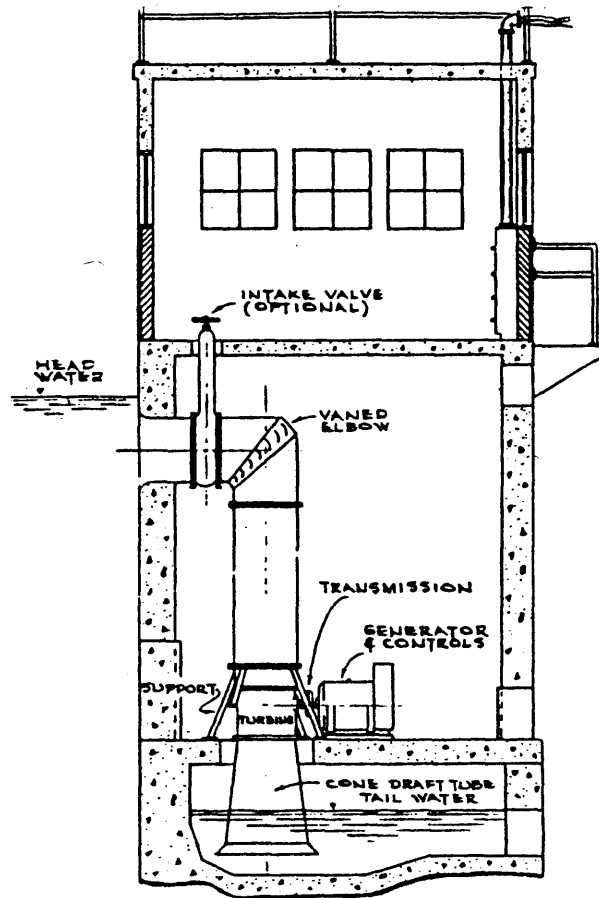
The machine has evocative qualities derived from its physical presence. There are symbolic, metaphorical and temporal readings which are implicit in its sense of place.

The connections between use and form suggest more than that implied by the shed in the wilderness. This is a place where energy is released; a place of potential and result. The motion of water through the complex, providing its energy and self-sustaining nature becomes an analog for the activities of the place. It is about transformations; of energy in its most raw and natural state to energy in a form which is not made by man but rather managed by him. In the same way, the processes which take place within the place involve the manipulation of natural materials and forms to those effected by the human hand. The power of this link lies in the fact that the transformations are codependent.

The tectonics of the buildings begin to suggest more about their uses. The foundry is construction almost exclusively in metal, it is constructed by the same manner of materials as its purpose would suggest. The pottery and ceramics studios are primarily concrete. These material selections stems from the spatial fact of their location between earth and water, the fundamental components of both their use and their construction. In the assemblage area the extension of the retaining wall structure and the scaffold-like framework join to suggest notions about the activities going on underneath. Lastly, the glass studios, raised up above the ground plane, are wrapped in industrial sash to capture the surrounding nature and admit working light.

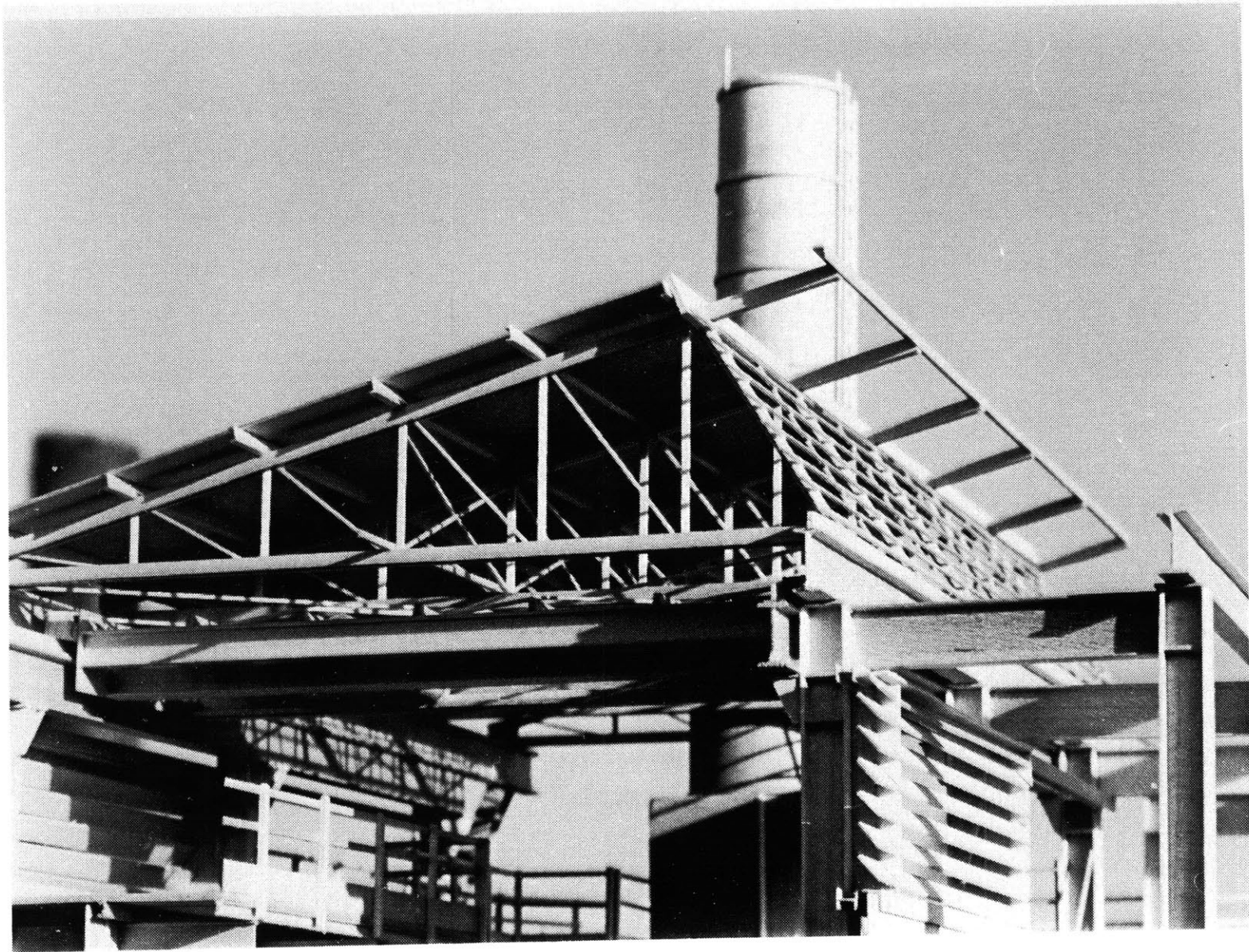
The issue of light and nature become fundamental to the understanding of the project. By building in the dark, and seasonally static portion of the gorge, the linking of light and nature becomes critical. With the exception of the setting sun which is able to illuminate the

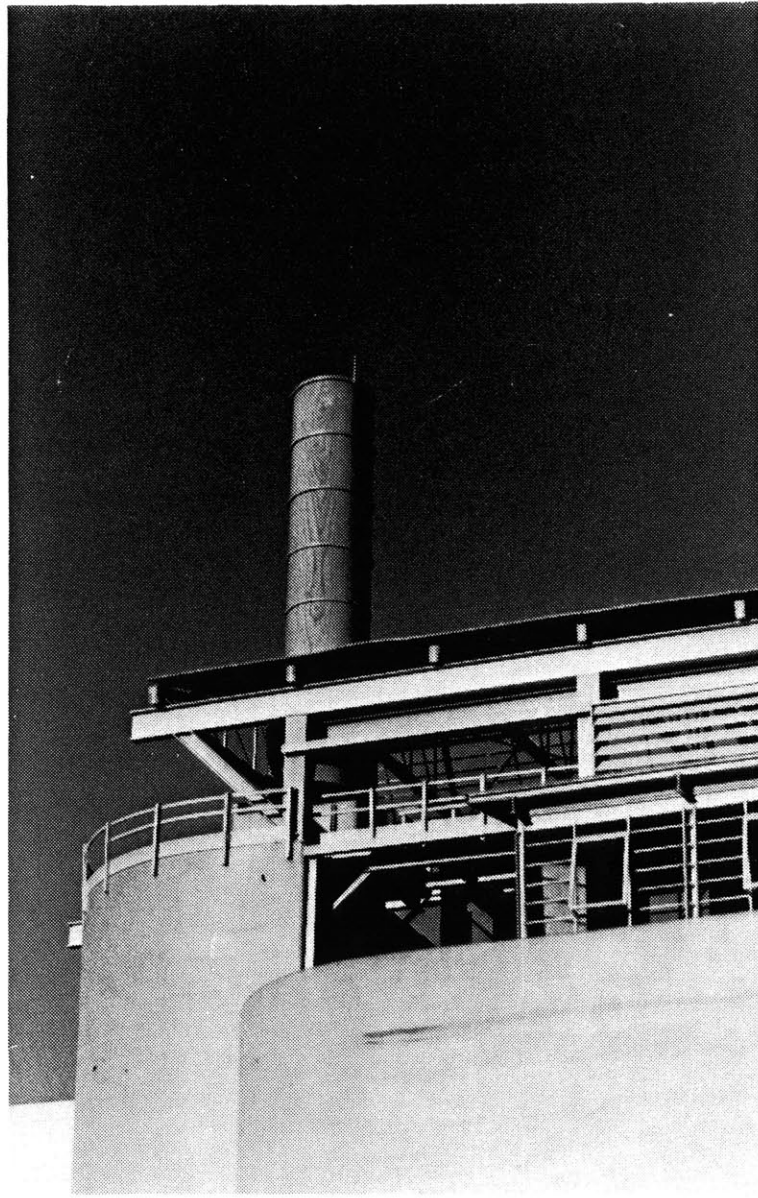




entire length of the gorge at different times of the year, the primary means of bringing light into the working spaces comes by means of refracted light, bringing with it the natural condition of the north slope of the ravine. With the exception of the casting hall and some of the support areas which are underground or in the foundation, all of the habitable spaces are positioned to receive the reflected natural light. This natural light is captured across the gulf in the same manner that the water is held and used along it.

Through the interdependence of the site mechanics and the uses in the place, the notion of the dam and the buildings atop it begin to be blurred. This is reinforced by the displacement of the concrete ground forms from the kiln end of the ceramics and pottery studio and the furnace end of the glass studio. The interweaving of ground form and sky form begin to become blurred as a result of the interaction between the two. In the same way the separation of dam and foundation is lost. Thus, the framing of the programmatic interde-





pendency of the two hints at the possibility of other interdependencies which are suggestive of organisms rather than machines.

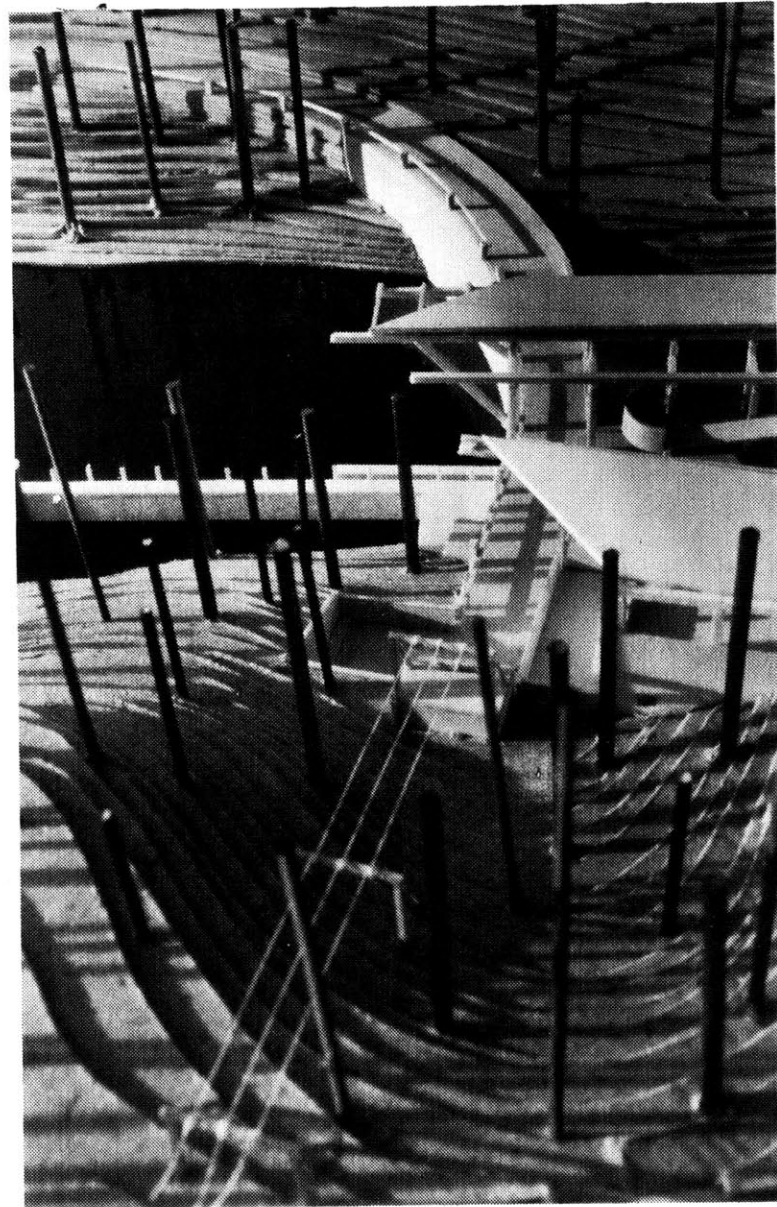
The earlier mention of the notion of the tree on the rock contains more than a description of an observed site condition. It implies the confluence of divergent conditions, the permanent and static juxtaposed against the temporary and dynamic. It also suggests a relationship which is based on dependency. The rock, the primordial artifact, will exist with or without the tree; the tree is entirely reliant on the rock in an hostile environment. In the end, when the tree is gone the rock will remain. There exist other conditions of time in this place. They range in temporal scale from the machine, the nature in which it finds itself and, finally, to that of the ravine itself.

The mechanics of the place are the most understandable means of reading the daily cycle. The ever present roar of the turbine and hum of the generator provide the datum against which the inhabitation of the place can be understood. Like the water which powers them, they are constant and unwavering, the sleeping heartbeat through the night. At morning other sounds begin to chirp in, the clank of an arriving pick-up; the roar of the first blast in the cupola; overhead doors clattering upwards; the static crackle of welding; kilns firing to life; power tools screaming; the frenzy of a busy and industrious day.

As the day ends the noises begin to subside; things are turned off; students and faculty leave; a last furnace is put out leaving only the sounds of the turbine and generator to carry on until the next day.

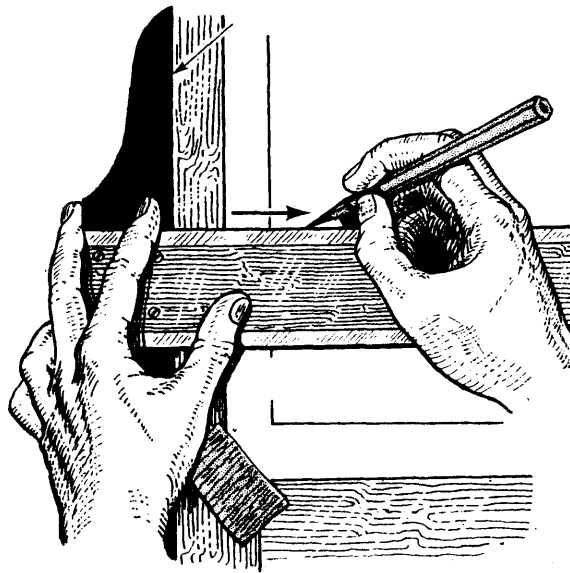
The annual transformations of the vegetation on the north slope of the ravine contrast starkly with the machine and its setting in the south wall. Through its continuity, and connection with the south slope, the machine participates in the creation of the datum by which the seasonal changes are interpreted. It is a fixed frame for its surroundings: water flows through, light and seasonal changes modify its character although its form remains constant. Like the stasis of the south slope or the metaphorical rock, it is a relative fixture against which the natural metamorphoses can be activated.

Epochal is the nature of the temporal framework of the ravine. The clear possibility of the destruction or abandonment of this machine suggests a much longer time framework than that of the machine or its natural surroundings. It speaks to a legacy of inhabitation in a volatile setting, one in which the time frame of these interventions is brief in comparison to this more fundamental time. Implicit here is the concession that, eventually, the ravine will reclaim the machine and reduce it to another of its artifacts; the remnants of the machine will have become part of the archeology of the site.

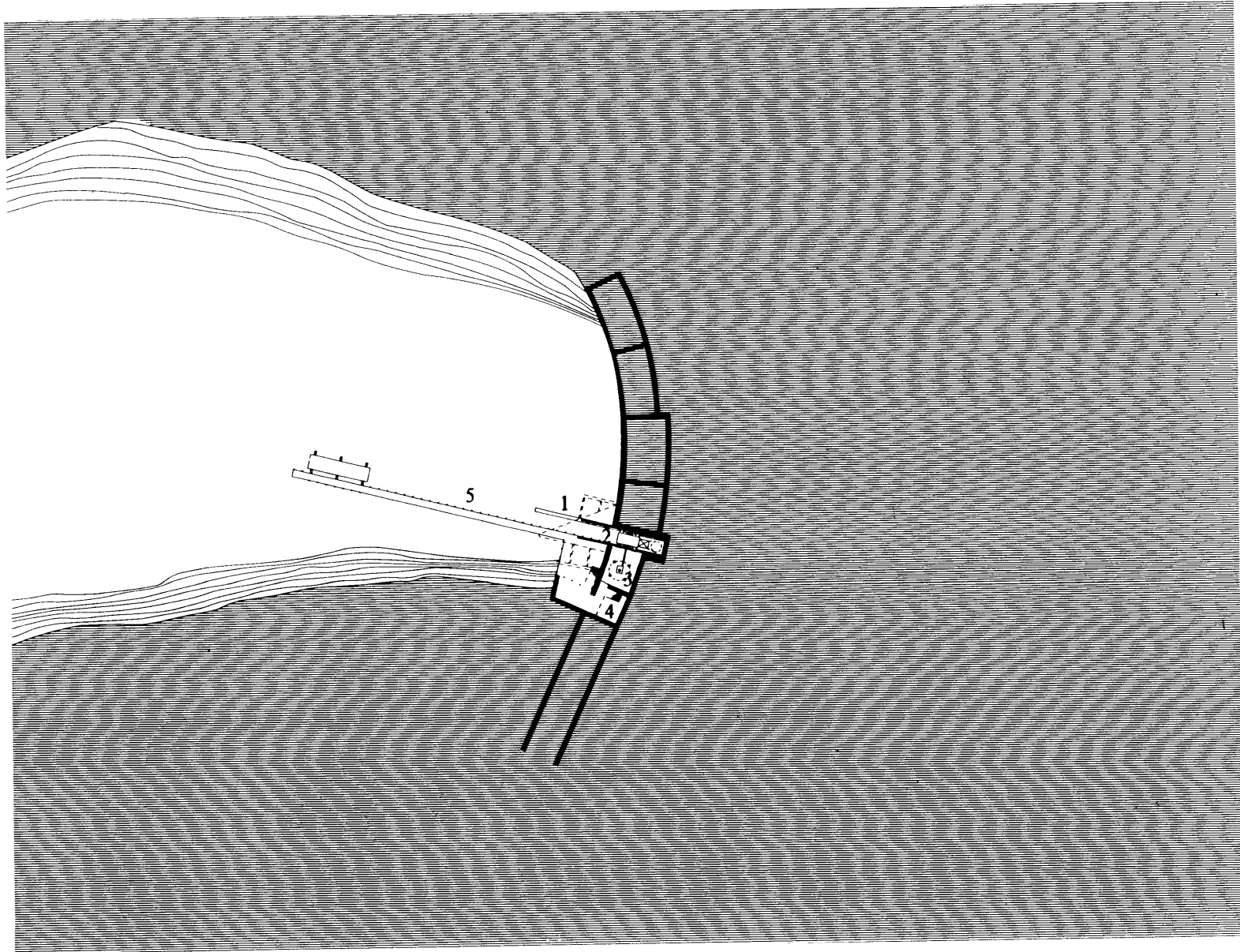


Plans

Elevation +234'
Tailrace

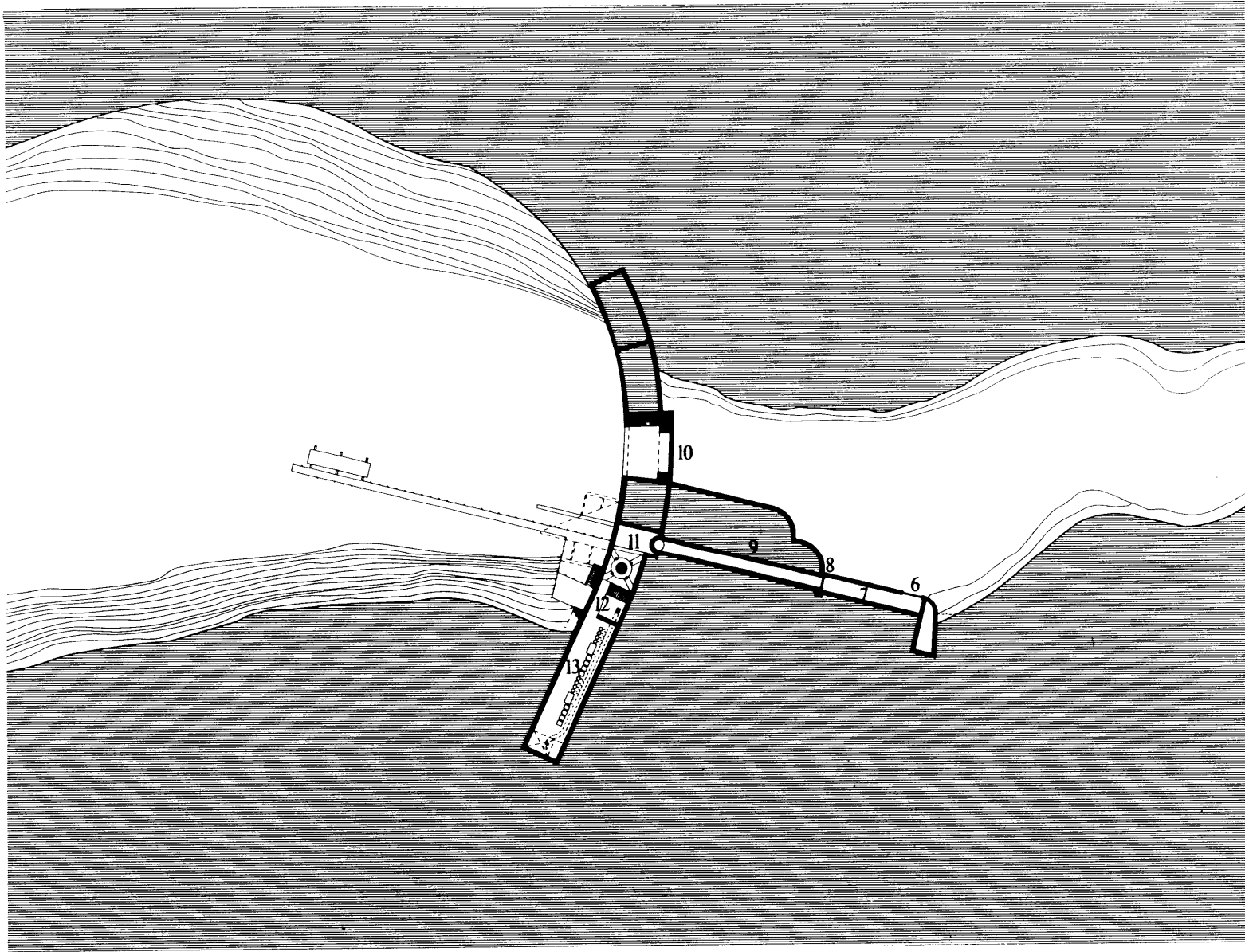


- 1 Outlet Gate
- 2 Banki Turbine
- 3 Transfer Gears
- 4 Machine Room
- 5 Tailrace



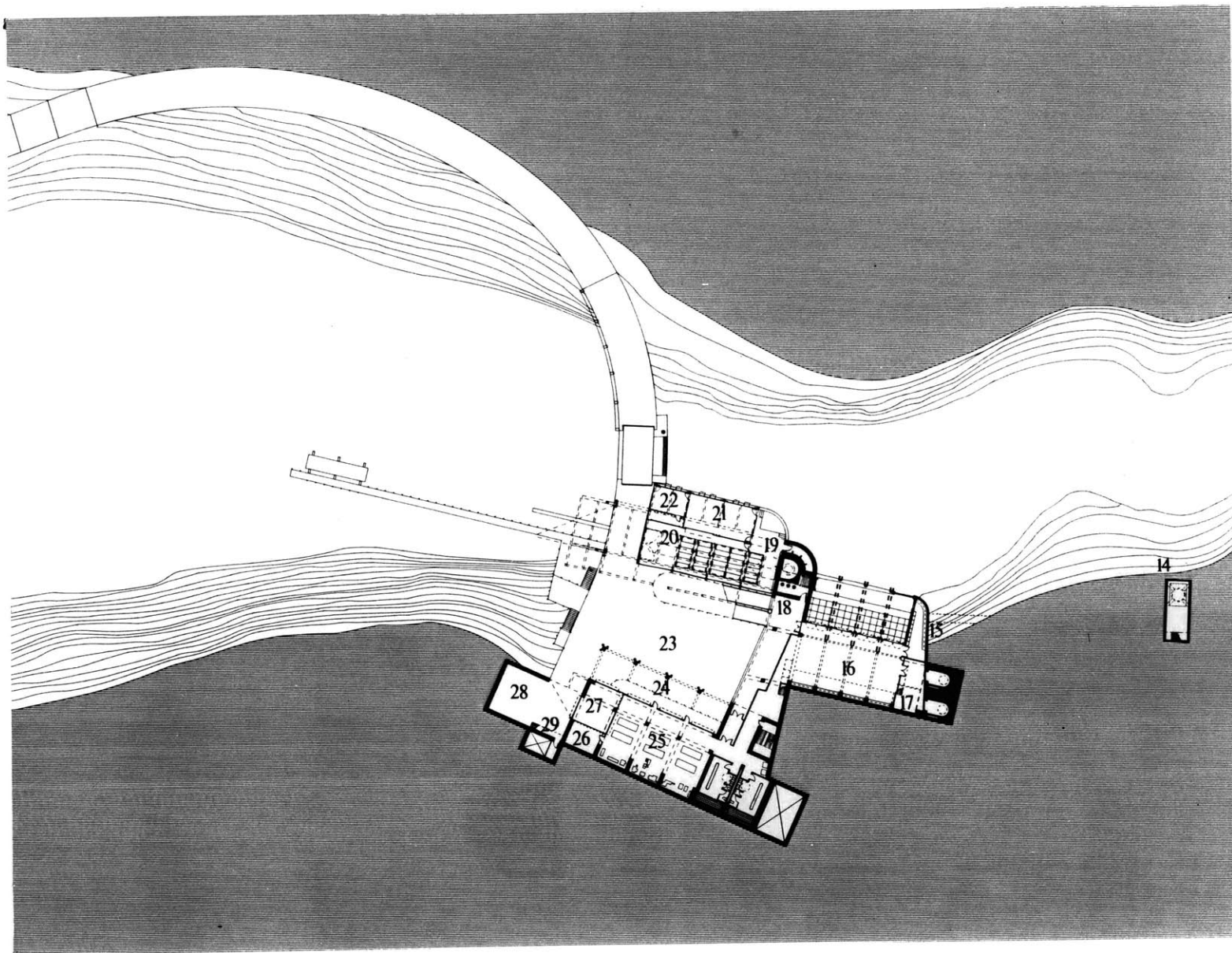
Elevation +244'
Penstock

- | | |
|----|-----------------|
| 6 | Trashracks |
| 7 | Forebay |
| 8 | Inlet Gate |
| 9 | Penstock |
| 10 | Flashboards |
| 11 | Generator |
| 12 | Access Platform |
| 13 | Switchgear Room |



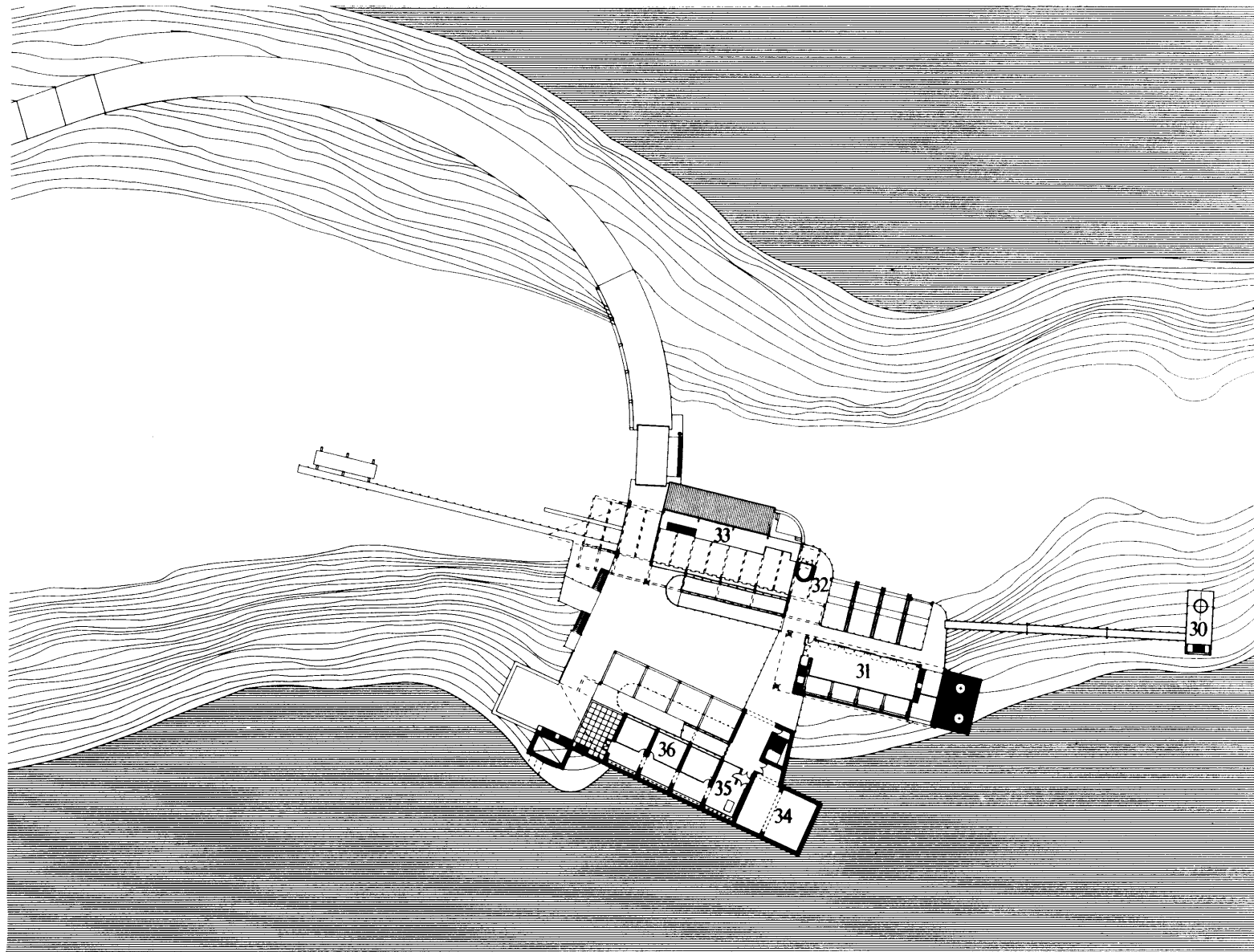
Elevation +254'
Delivery Bay

- 14 Wood Crib
- 15 Prefire and Clay Storage
- 16 Ceramics and Pottery Studio
- 17 High and Low Fire Kilns
- 18 Valve Control Room
- 19 Bot Valve
- 20 Casting Beds
- 21 Chasing Room
- 22 Foundry Tool Cage
- 23 Delivery Bay
- 24 Assemblage Area
- 25 Wood and Metal Studio
- 26 Wood and Metal Tool Cage
- 27 Lumber Racks
- 28 Welding Pit
- 29 Transformer Vault



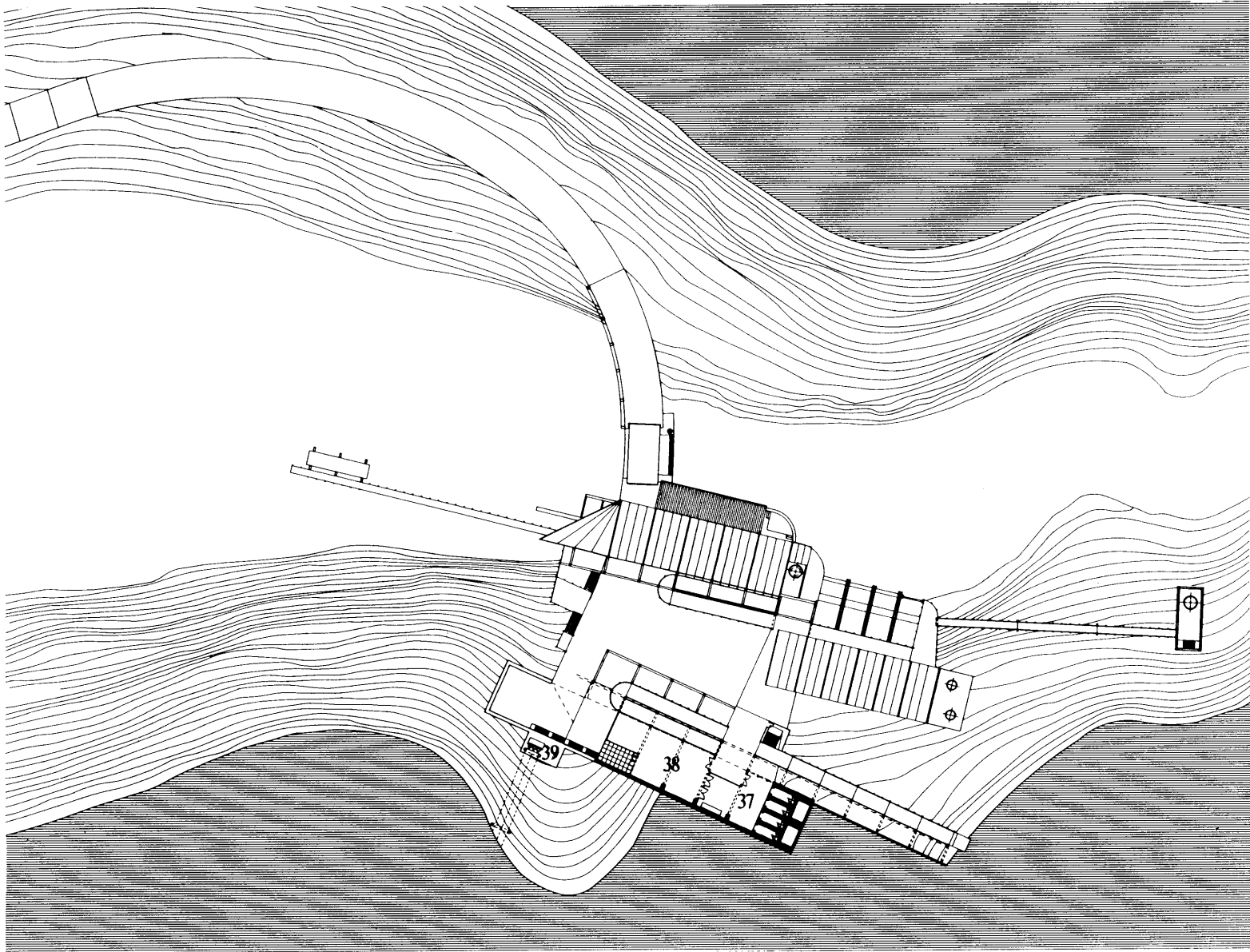
Elevation +270'
Cupola

30	Raku Kiln
31	Classroom and Gallery
32	Cupola
33	Charging Platform
34	Storage
35	Faculty Office
36	Faculty Studios

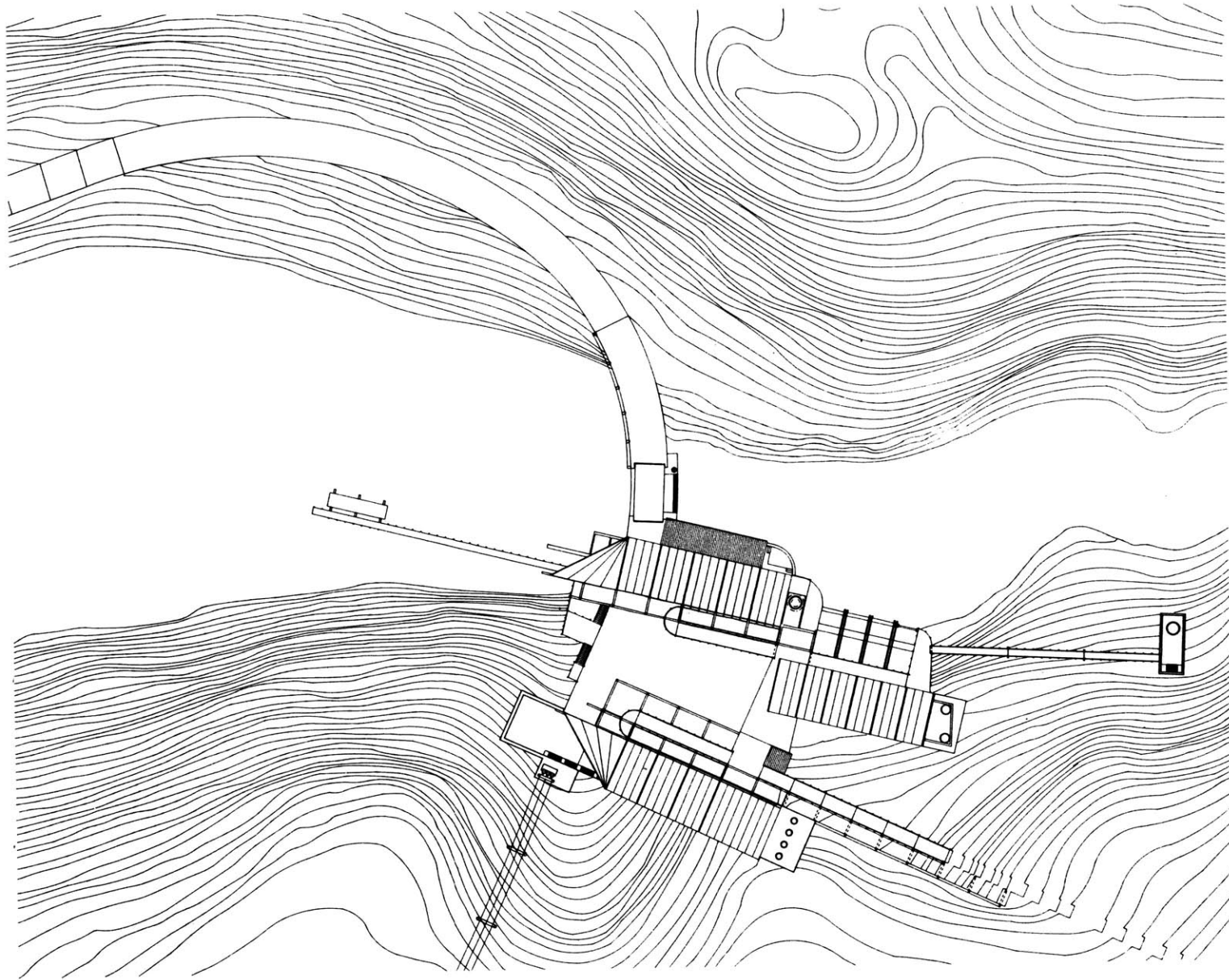


Elevation +286'
Transmission Platform

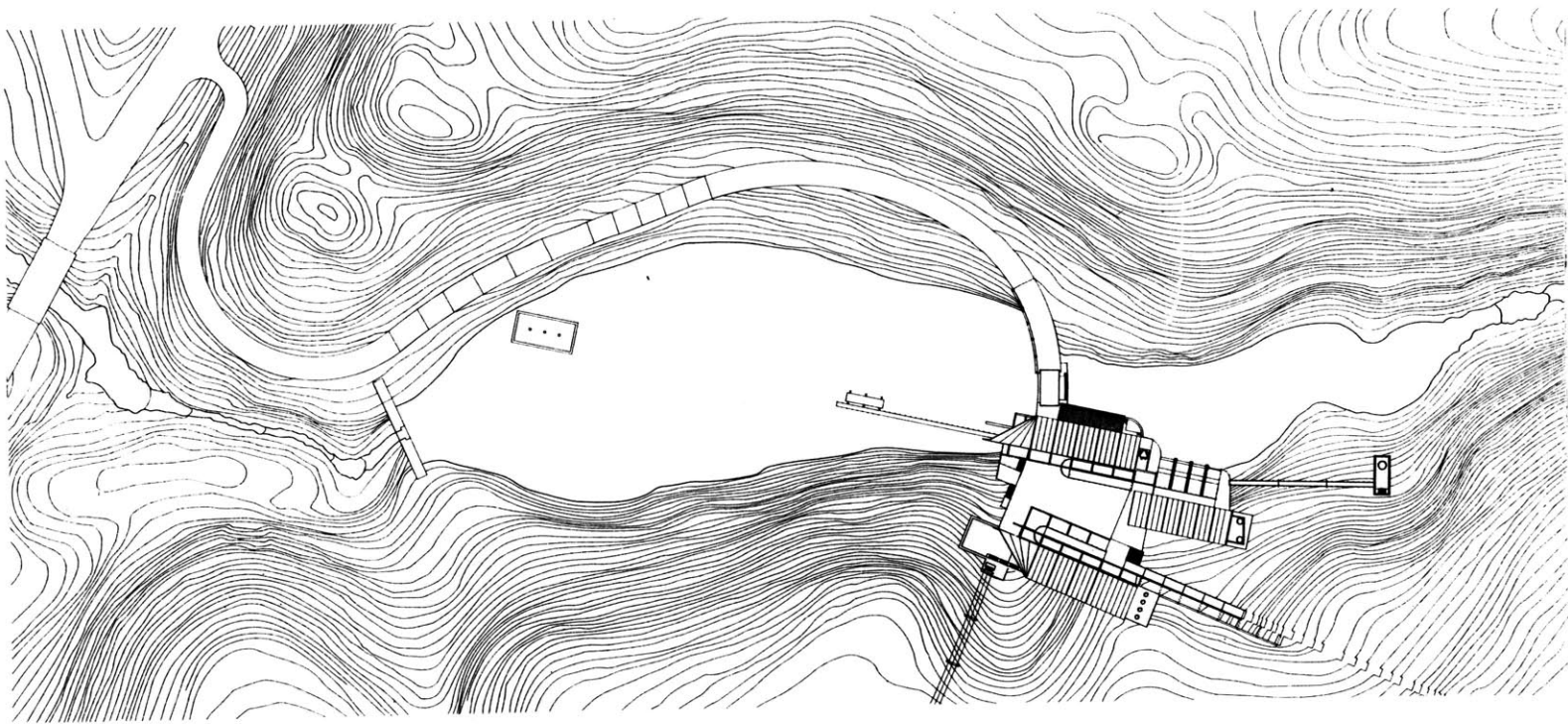
- 37 Glass Furnaces
- 38 Glassworks Studios
- 39 Transmission Platform



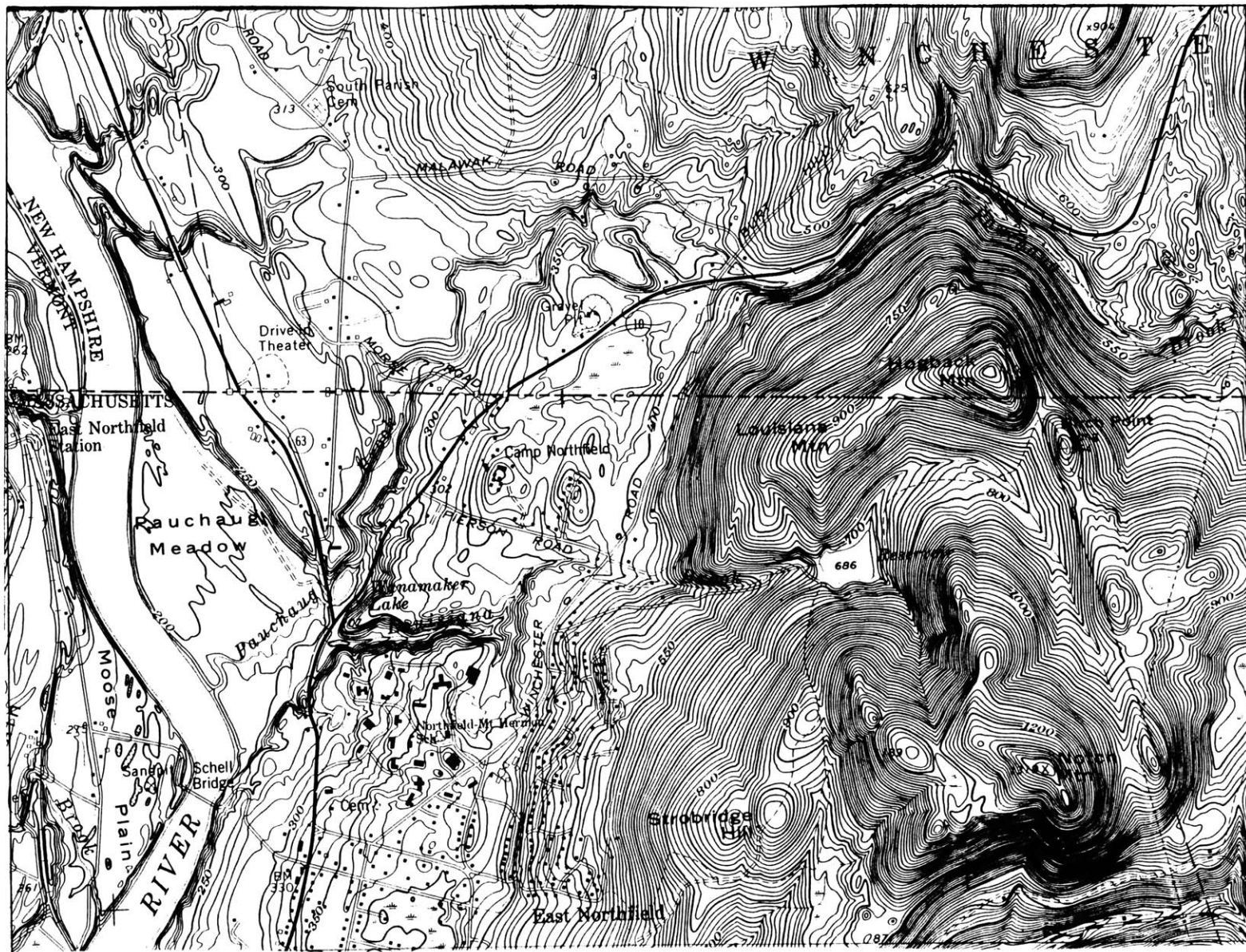
Elevation +348'
Entry and Bridge



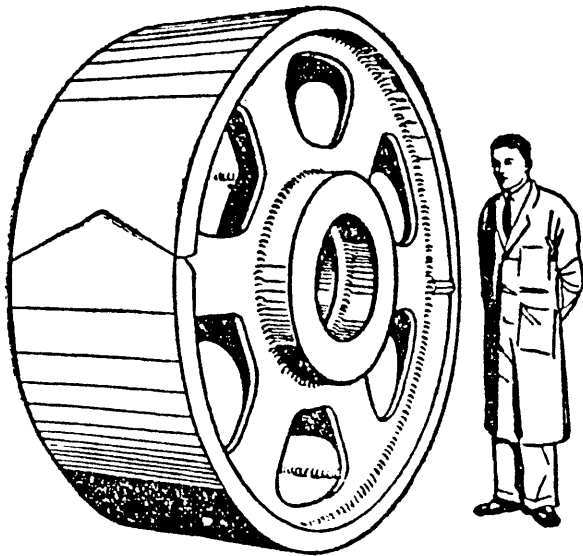
Elevation +348'
Louisiana Gulf



Locus Plan
Connecticut River Valley



Summary



The design project described previously has served a test of a position about understanding the implications of technology in architectural and landscape decisions. It has confirmed that building with a sense of materiality is realistic, as is understanding and accepting the clarity of form which results from operational mechanics of a place. Further, it compels the application of the same rigor to the means of siting and landscape manipulation in architecture, the mechanics of site. Lastly, it suggests that while authenticity may be a derivative of these positions, there are some difficult issues in the resolution of technology and architecture beyond the realm of this design project.

It must be understood that materiality and clarity of form are not explicit goals in an architecture of authenticity. Rather, they are allied sensibilities which govern working methods and design decisions. When they are ignored, the critical components of the act of building is weakened. When they become the fundamental architectural idea, the aesthetic changes from one of revelation to one of celebration. In the absence of larger intentions toward landscape, space and use they, are not able to produce an architecture of empowerment alone.

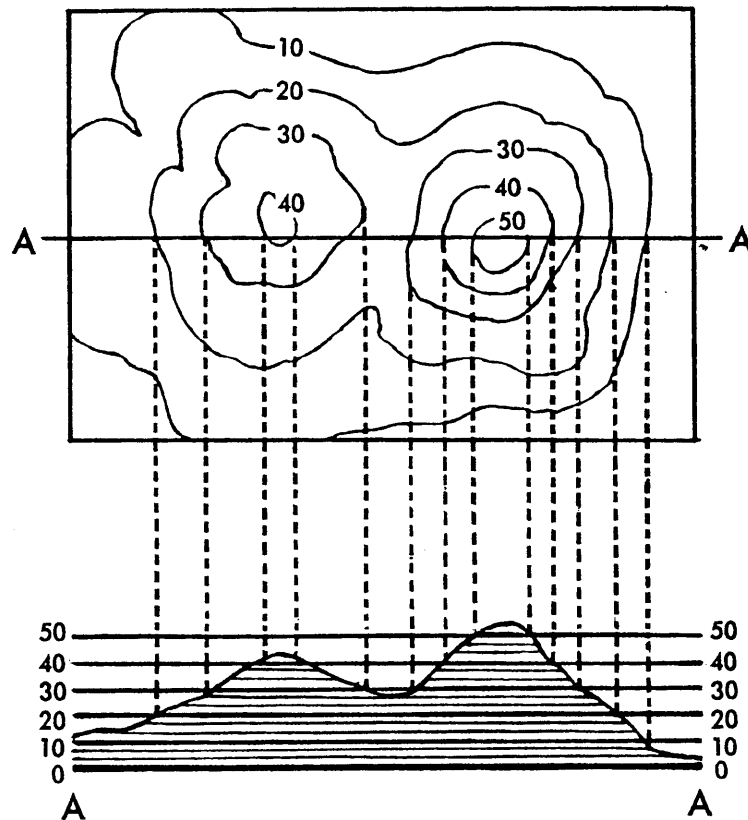
An extension of these positions lies in the understanding of the mechanics of the site. There are clear technological issues which are present in any intervention into the landscape. When these issues are allowed to participate in the making of form, they provide an opportunity to build in the landscape rather than against it. Implicit in this position is the notion of disrupting but not destroying the landscape. This suggests buildings where the tension between the sustaining aspects of architecture and the mechanics of decay is evident.

The formulation of this design problem was such that the opportunity to test the notions of materiality and clarity of form was unavoidable. As a result of this investigation and understanding of the applications of this sensibility to interventions in the landscape became clearer. More difficult testing of these sensibilities lies beyond this project. How does one apply them in acts of building when operational and site mechanics are less determinant?



Appendices

One: Process



The following models and collages were created as a part of the development of the design portion of the thesis undertaking from November 6, 1990 to April 25, 1991. The initial efforts focused on the clarification of intentions toward both the site and the buildings and their relationship; these conceptual positions were developed through sketch and analog models .

The primary development of the design occurred through multiple iterations on the primary conceptual positions. More explicitly, the development of the design focused around alternate modeling exercises at $1/32" = 1'-0"$. This scale was selected as it seemed to allow for simultaneous investigations of both the landscape and human scales. These models were used to test the relationship of individual components of the design back against the original design intentions as well as those put forth in the statement of the thesis. These exercises were typically followed by drawing and writing sessions aimed at synthesizing and filtering the information developed in the various three dimensional media as well as providing a launching point for the next iteration.

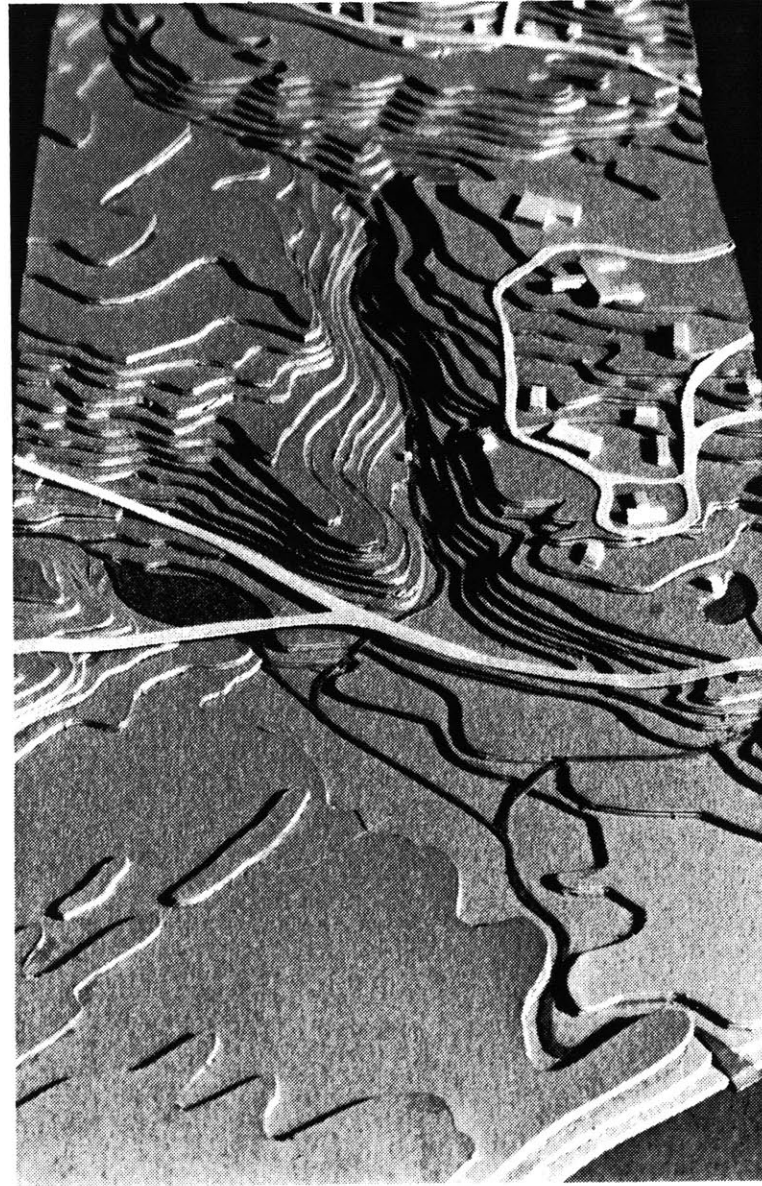
The initial strategy for the development of the design was to focus on the simultaneous development of the project over three scales; environmental, anthropometric and tactile while remaining true to the initial concepts. Landscape and site models were to be used to explore the relationships of defined volumes and territories to the land and one another. Sectional and frozen space models focused on the human scale which, was seen as the mediation between the environmental and the material scales. Additionally, detail models, conveying tactile and constructed qualities, were be used to explore the materiality of the architecture at its smallest and most perceptible scale. The focus on the landscape issues early in the semester preempted a complete investigation into these secondary and tertiary scales. By designing "down" from the environmental scale as well as "up" from the tactile, it was hoped that a fusion of scales would occur throughout the landscape and buildings and in so doing there would be gained a fundamental sense of place, both physical and temporal.

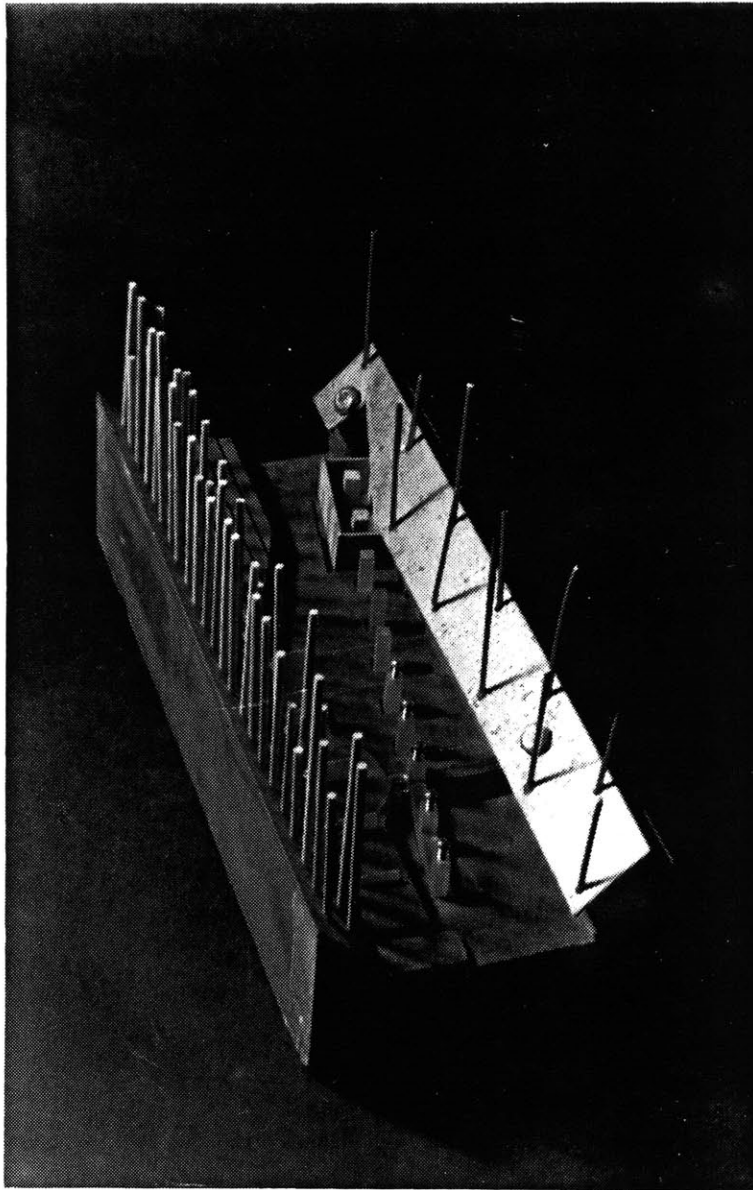
Strobridge Hill

November 6, 1990

1" = 500'-0"

Chipboard, Canson Paper, Basswood





Timeline

November 11, 1990

No Scale

Hydrostone, dry tempera, galvanized steel, plexiglas, basswood, lead, various fasteners, epoxy resin.

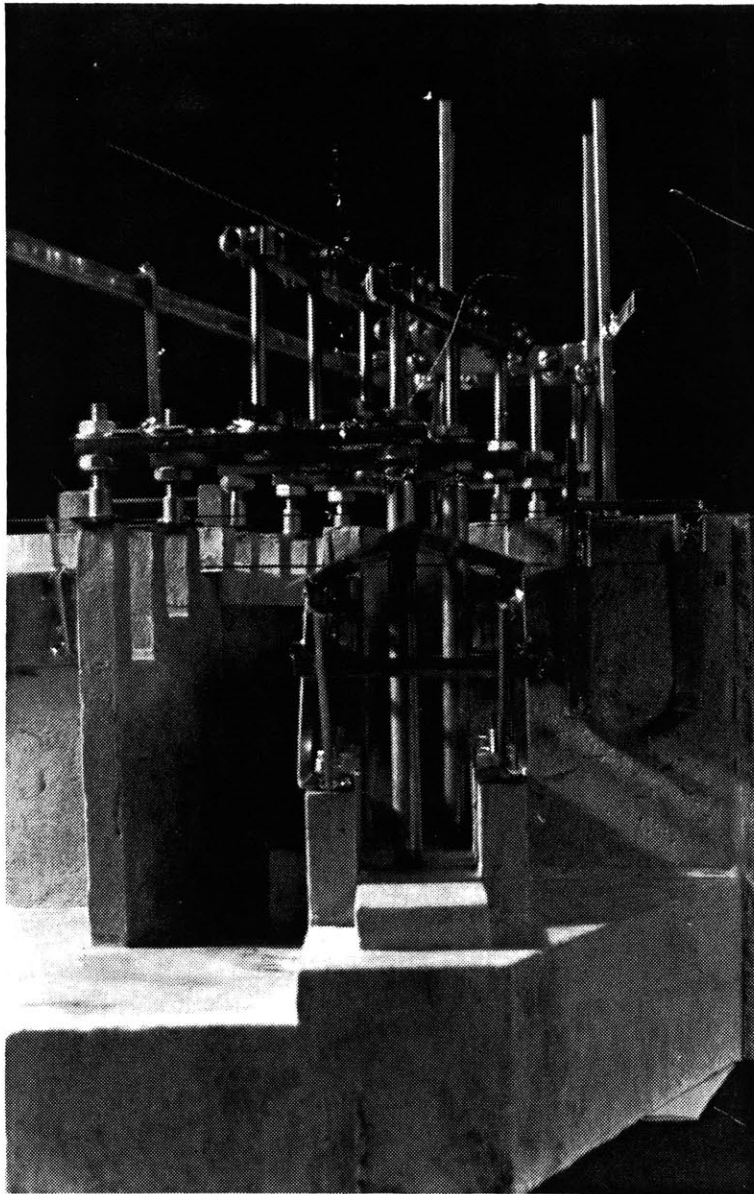
Louisiana Gulf

January 16, 1991

1" = 100'-0"

Chipboard, plywood, basswood, birch doweling, rubber cement.





Clinging On

January 28, 1991

No Scale

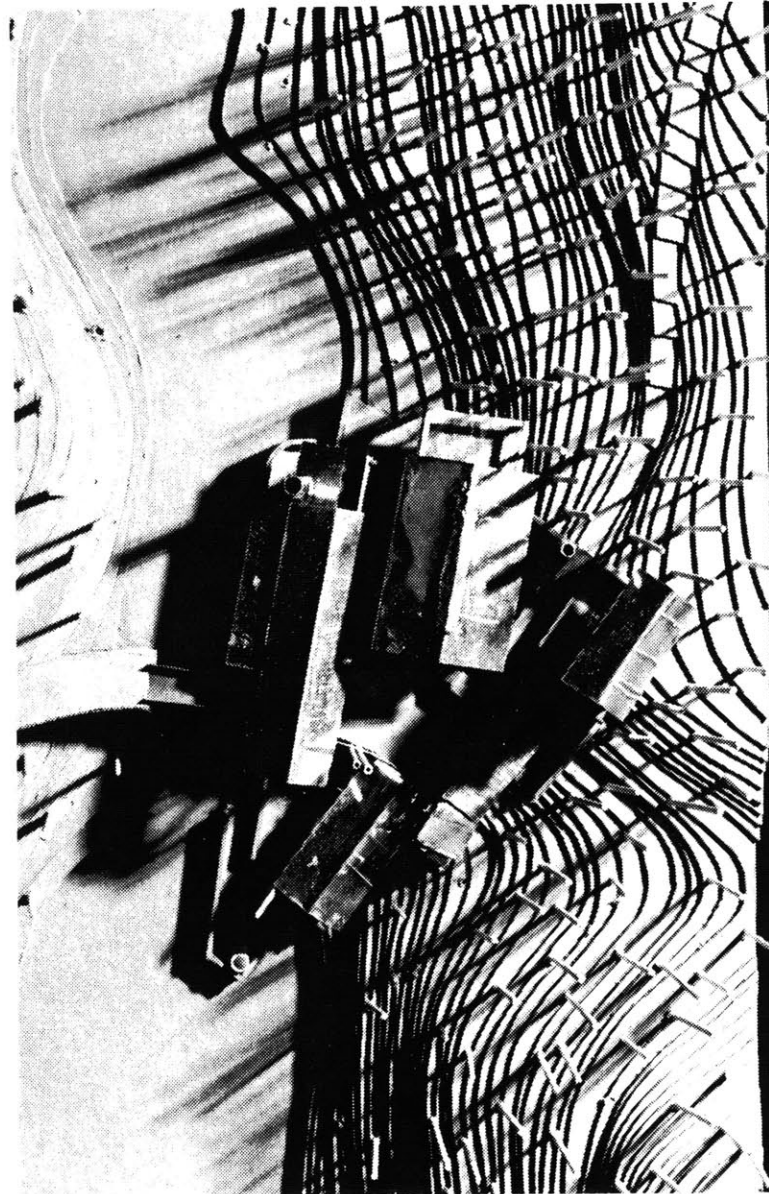
Hydrostone, dry tempera, brass, solder, threaded rod, epoxy resin,
various fasteners.

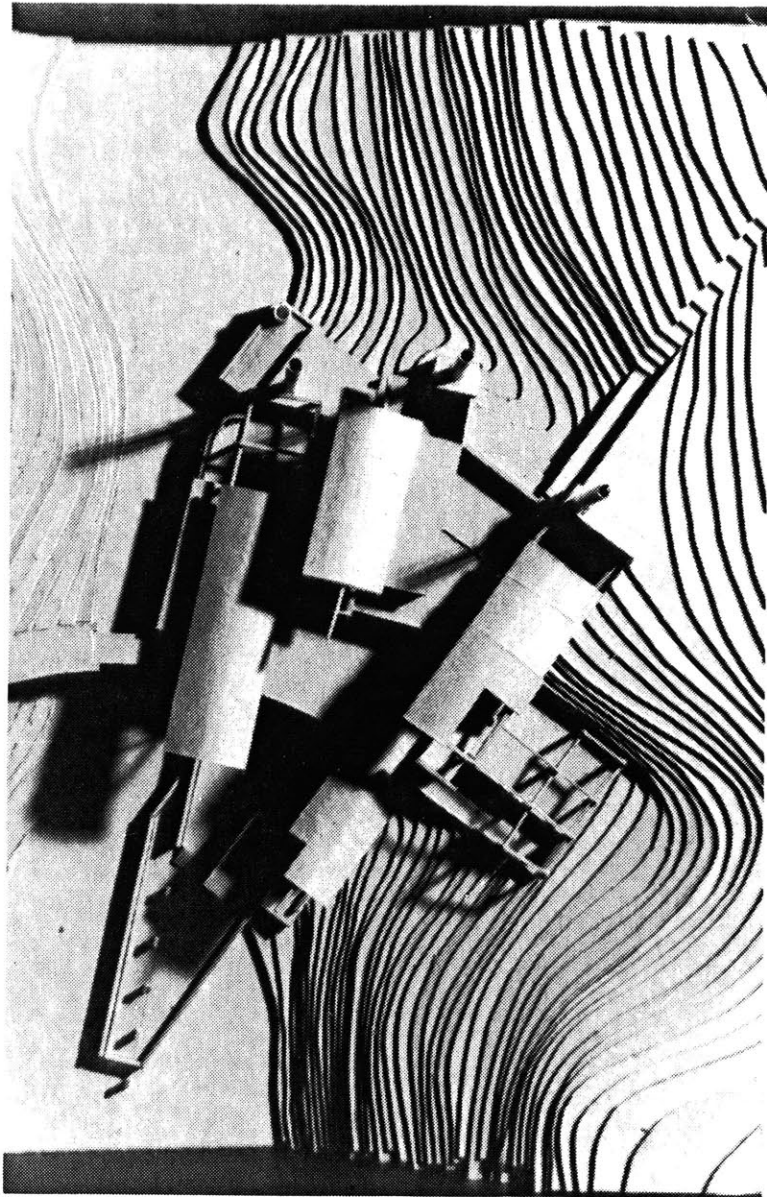
Happy Village

February 28, 1991

1/32" = 1'-0"

Chipboard, CDX plywood, basswood, tin, solder, stainless steel screen, galvanized screen, birch doweling, rubber cement.





Battlestar

March 7, 1991

1/32" = 1'-0"

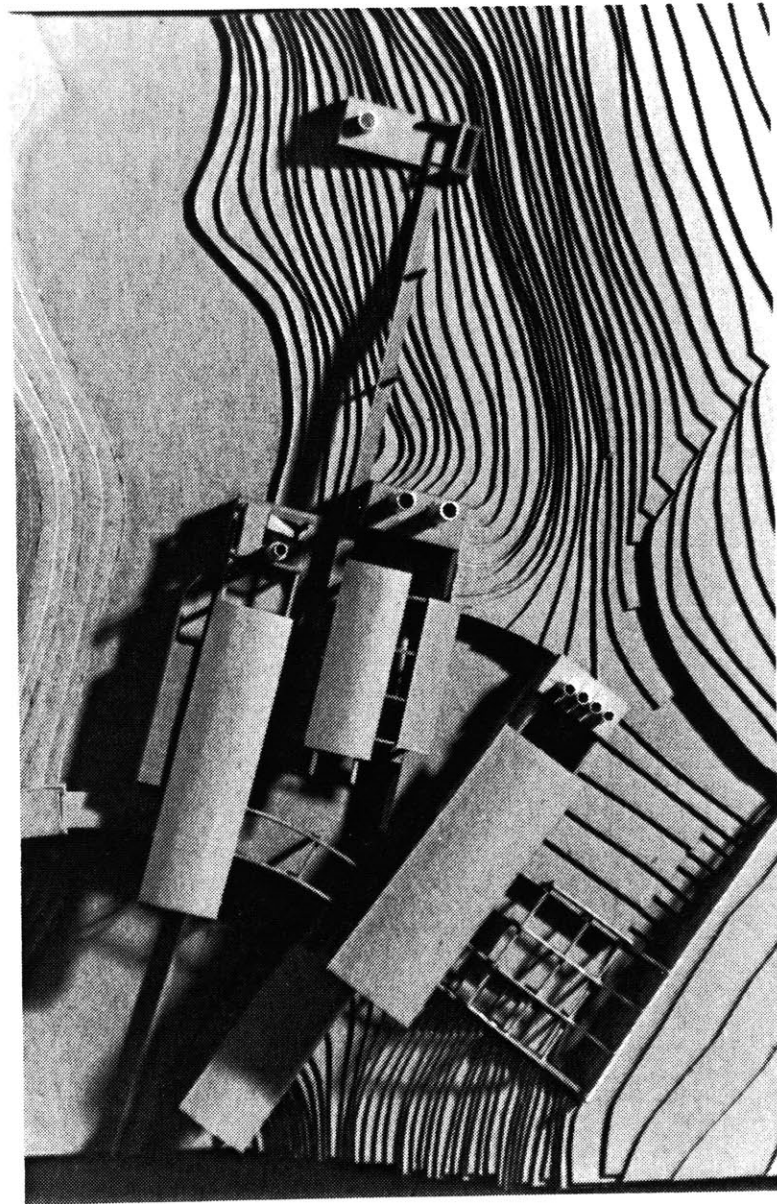
Chipboard, CDX plywood, tubular aluminum, rubber cement.

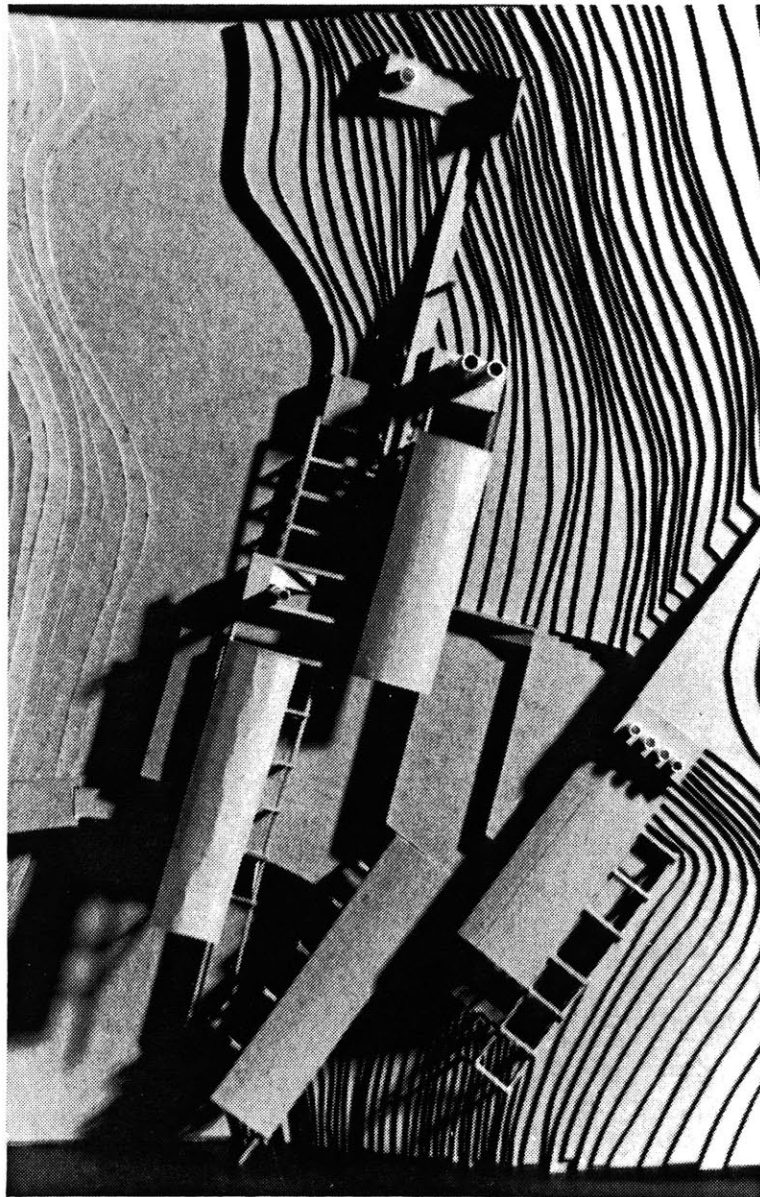
Cage Match

March 14, 1991

$1/32" = 1'-0"$

Chipboard, CDX plywood, tubular aluminum, rubber cement.





Colliding 747s

March 21, 1991

1/32" = 1'-0"

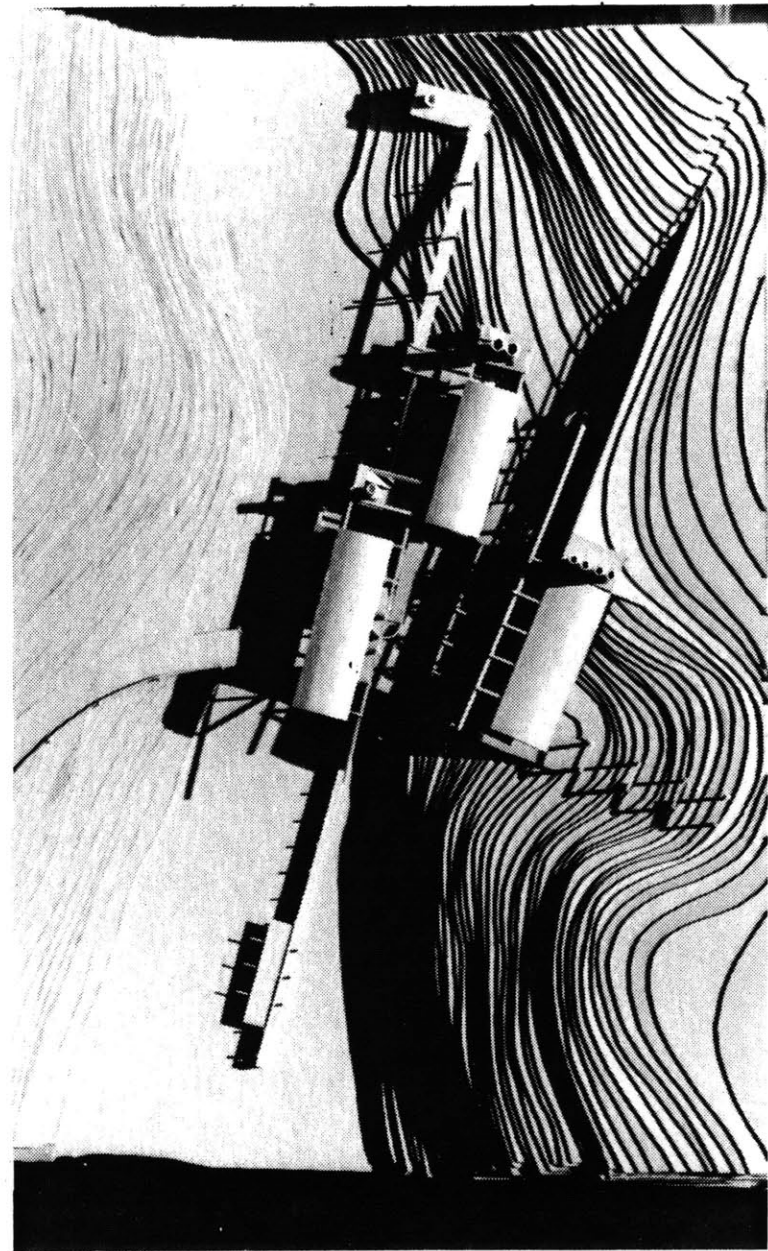
Chipboard, CDX plywood, tubular aluminum, rubber cement.

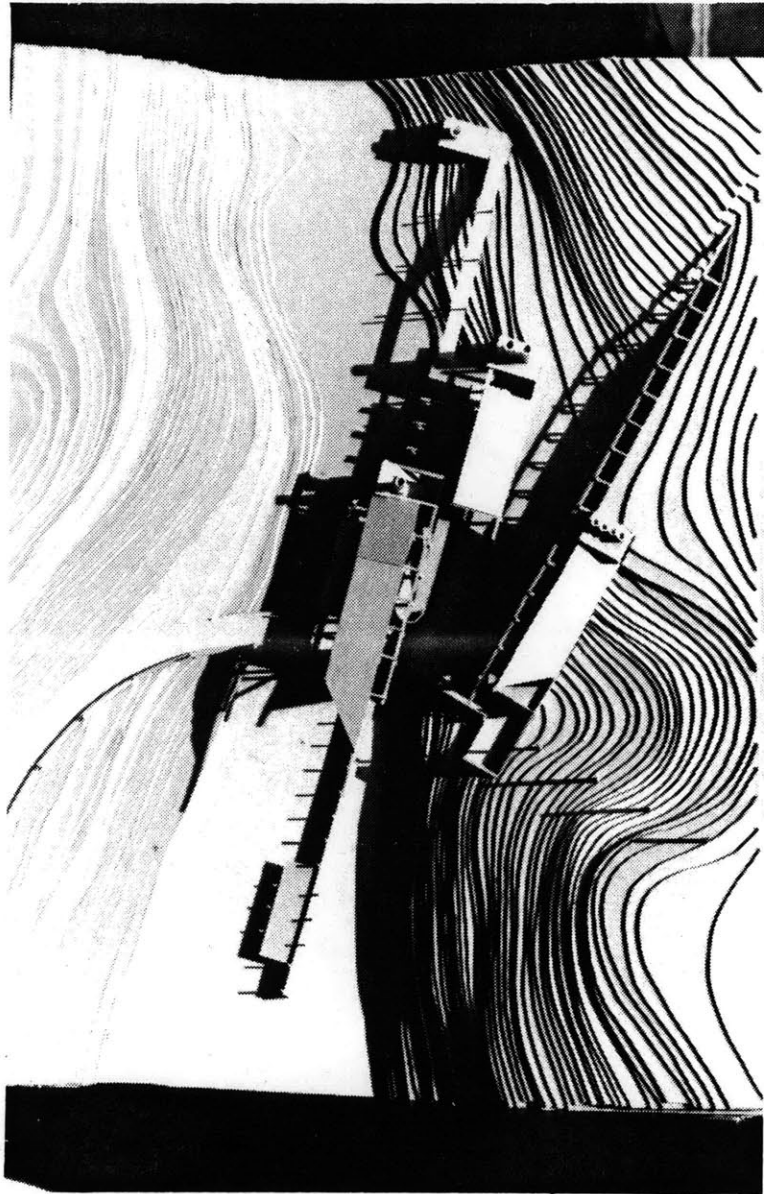
Fire Pond

March 28, 1991

1/32" = 1'-0"

Chipboard, CDX plywood, tubular aluminum, rubber cement.





Soldier Piles

April 4, 1991

1/32" = 1'-0"

Chipboard, CDX plywood, tubular aluminum, rubber cement.

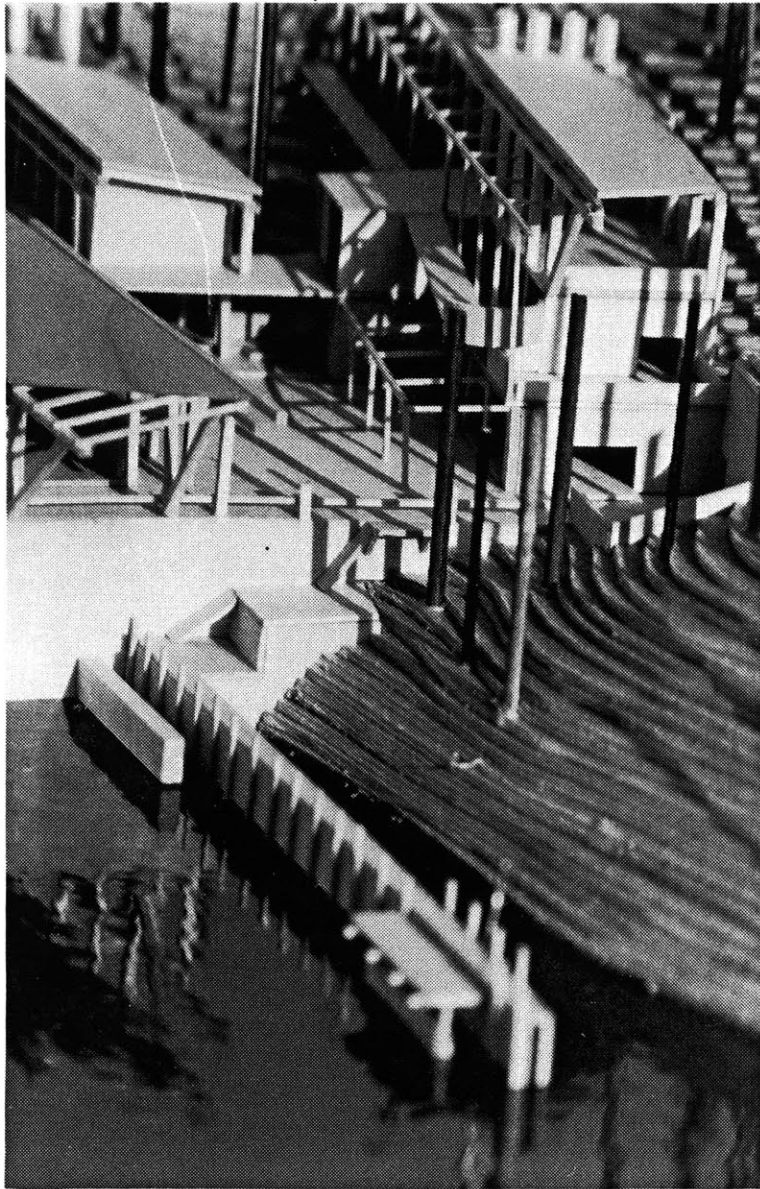
Sawtooth

March 7, 1991

1/4" = 1'-0"

Birch plywood, Basswood, Aircraft plywood, white glue.





Broken Arrow

April 21, 1991

1/32" = 1'-0"

Basswood, chipboard, tubular aluminum, CDX plywood, frisking film, birch doweling, rubber cement, white glue.



Two: Program

9	LARGE GEAR, PRESSED	2	C.I.
8	LARGE GEAR, KEYED	1	C.I.
7	WHEEL SPINDLE	1	STEEL
6	CRANK SPINDLE	1	STEEL
5	CRANK	1	C.I.
4	CLAMP SCREW CAP	1	C.I.
3	CLAMP SCREW HANDLE	1	C.I.
2	CLAMP SCREW	1	STEEL
1	HOUSING	1	C.I.
NO.	PART NAME	REQD	MAT.
JOHN SMITH AND CO. ST. LOUIS, MO.			
GRINDER ASSEMBLY			
DR. BY	6-22-48	CK. BY	6-22-48
TR. BY R.D.J.	6-22-48	APP. BY	6-22-48
SCALE: FULL	SECTION 80-X	R-145	

The programmatic considerations for this project stem from the desire to consolidate and improve a series of teaching facilities for ceramic, and sculptural arts which are currently located in dispersed sites around a boarding school campus in Western Massachusetts. Additionally, there is a desire to add glass blowing and glass sculpture to the fine arts curriculum while expanding the capabilities of the existing options in sculpture, ceramics and pottery through improved plant and equipment. The relocation of these facilities to a new site is also intended to allow for the expansion of painting, printmaking, weaving, and drawing disciplines into spaces in existing building on the adjacent campus. The mandate for the development of this new center results from the efforts to revitalize a somewhat dormant fine arts department as the result of significant financial contributions from a small group of alumni.

The specific program, detailed at right, is an amalgam of those programs developed for similar schools and small colleges throughout New England. The facilities have been intentionally enlarged to accommodate a start-up "Arts in the Valley" program which would host intensive summer-long arts teaching workshops for professionals and other interested artists. Like the existing summer school and summer retreat programs, it is seen as a means to generate year-round income from the campus. This facility would be directed by three or four faculty members with a small staff which would be augmented by student labor which is part of the school's operating philosophy.

This philosophy encompasses the entire operation of the school where students, regardless of financial background or tuition paid, participate in the operations of the school. These operations include a working farm on which provides vegetables, milk and butter, an orchard for apples and cider in the fall, and the tapping of the sugar maples on campus to provide syrup in the spring. This espousal of self-sufficiency directs the decision to attempt to make the arts center as autonomous as possible. The decision to take advantage of the potential energy source afforded by the adjacent Louisiana Stream, through a small scale hydro-electric generating station within the center, is an extension of this position.

Requirements

Exterior

Parking	650 SF
Delivery Bay	1500
Materials Storage	200
Propane Storage	200
Assemblage Area	1200
Raku Kiln	200
Welding Pit	225
Transmission Platform	150
Forebay	400
Penstock	200
Tailrace	200
Sub Total	5125 SF

Semi-Exterior

Cupola	125
Charging Platform	300
Glass Furnaces	150
Blowing Frames	300
Casting Beds	800
Flasking Frames	150
High Fire Kiln	100
Low Fire Kiln	100
Assemblage Area	800
Wood Crib	200

Sub Total 3025 SF

Interior

Wood and Metal Studio	1250
Wood and Metal Tool Cage	200
Ceramics and Pottery Studio	1200
Prefire and Clay Storage	200
Ceramics and Pottery Tool Storage	50
Chasing Studio	900
Foundry Storage	100
Foundry Tool Cage	200
Faculty Offices	400
Faculty Studios	1200
Classroom and Gallery	900
Female Lockers, WCs and Showers	450
Male Lockers, WCs and Showers	450
Storage	500
Turbine and Frame	400
Generator	450
Switchgear	450
Machine Room	300
Transfer Gears	250
Transformer Vault	200
Sub Total	10050 SF

Total 18400 SF

Sources

Written



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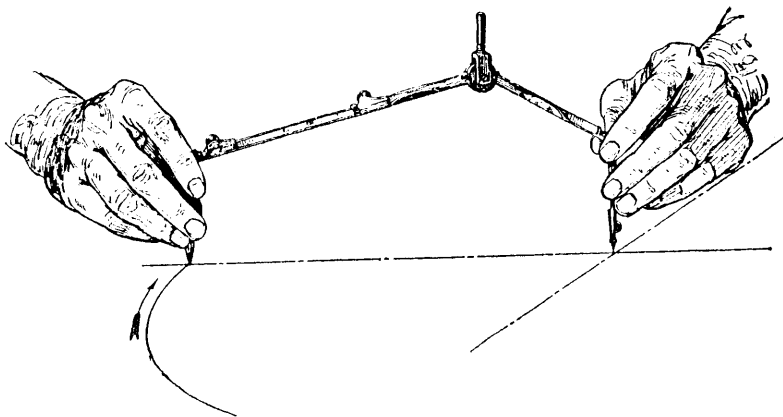
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Page 50 **Louisiana Stream**
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Page 51 **Tree on Rock**
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Page 52 **Foundry Elevation**
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Page 53 **North Bank from South Bank**
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Page 55 **Charging Floor and Gantry Crane**
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Page 56 **Ravine Westward**
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Page 57 **Forklift Ramp and Exhaust Louvers**
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Page 58 **Frozen Birch**
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Page 59 **Clerestory in Casting Hall**
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Page 61 **Cupola and Charging Platform**
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Endnotes

- 1 Davis, Colin. **High Tech Architecture**, New York: Rizzoli International, 1988. Page 9.
- 2 Davis. Page 17.
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